June 6, 1962

X3 Sectional Committee
BEMA Headquarters
235 East 42nd Street
New York 17, New York

Gentlemen:

Attached you will find the following documents:

a) Proposed American Standard Code for Information Interchange, with Appendices A, B and C. X3.2/4

b) Expository Remarks on the Proposed American Standard Code for Information Interchange.

X3.2/5 May 25, 1962

c) X3.2 Subcommittee Resolution that the USA support Proposal B of ISO/TC 97/WG B Resolution 1 of 4 May 1962.

X3.2/6 May 23, 1962

d) X3.2 Subcommittee Resolution that documents X3.2/4 and X3.2/5 supersede documents X3.2/1, X3.2/2 and X3.2/3 in the current X3 ballot procedure.

X3.2/7 May 25, 1962

These documents are submitted with the recommendation that X3 Sectional Committee support Proposal B generated by ISO/TC 97 Working Group B at the Paris meeting on 4 May 1962 and with the request that documents X3.2/4 and X3.2/5, which are essentially consistent with Proposal B, supersede documents X3.2/1 through X3.2/3 in the current X3 ballot procedure.

With my letter of February 6, 1962, I forwarded for your approval the Proposed American Standard Code for Information Interchange (documents X3.2/1 dated 11-10-61 and X3.2/2 dated 2-02-62). These documents are, as you know, the subject of a current X3 ballot.

Since submission of these documents and issuance of the ballot a considerable amount of discussion and work with our European colleagues has resulted in significant progress toward an International Standard Code. A seven-bit code, contained in ISO/TC 97/WG B Proposal B of May 4, 1962, is now under consideration by Working Group B (WG B) for possible submission to ISO/TC 97 as an ISO recommendation. Working Group B has requested that its members submit their opinions for or against this code by September 15, 1962.

NMAH
310/3

The WG B code represents a relatively minor variation from that contained in the November 10, 1961 documents (X3.2/1 through X3.2/3) now in the formal process of X3 ballot consideration. The WG B code is felt fully to meet the criteria the X3.2 Subcommittee established for an information interchange code. In view of this fact a majority of the X3.2 membership felt that the USA should support the suggested seven-bit code contained in Proposal B. However, the following factors have led us to recommend support in a slightly modified form.

The comments of other Subcommittees of X3 have been solicited concurrent with this international activity. A formal response has been received from the X3.3 Subcommittee on Data Transmission. We have found a way to meet their requirements in the proposed standard code.

X3.1 and X3.4 have responded to X3.2 inquiries and find the Proposed Code acceptable at this time. We do not anticipate any problems in fulfilling their future requirements.

Discussions since the May 4 meeting of WG B have led to recognition of the need for a code signifying the end of the usable portion of the medium in which information is recorded. This code has been entitled LEM (Logical End of Medium).

Subsequent to the May 4 meeting, informal contact between members of the X3.2 Subcommittee and their European co-workers has led to the discovery that placement of the asterisk (*) and plus (+) in the code sets contained in Proposal B of WG B fails to take adequate account of the needs of the duo-decimal arithmetic used in Sterling monetary areas. Telephone contact with Europe has established a solution for this deficiency through the interchange of colon (:) with asterisk (*) and semi-colon (;) with plus (+).

The foregoing factors led the X3.2 Subcommittee to adopt a resolution dated May 23, 1962 (document X3.2/6) recommending that the X3 Sectional Committee support Proposal B in a form slightly modified to meet the requirements of the X3.3 Subcommittee, the need for an "end of medium" code, and the uses of the Sterling monetary areas.

At the time the November 10, 1961 proposed standard code (documents X3.2/1 and X3.2/2) was being considered by the X3 Committee for ballot, the principal concern expressed by committee members was that there was little evidence that international compatibility could be achieved by adoption of the proposed code. This objection, we feel, was valid and can be clearly overcome by substitution of a code revised to be consistent with the WG B result (but modified as stated above) for the code in the current X3 ballot procedure. By resolution on May 25, 1962 (document X3.2/7) the X3.2 Subcommittee voted to recommend to X3 that documents X3.2/1 through X3.2/3 be superseded in the current X3 ballot procedure by revised documents (X3.2/4 and X3.2/5 dated May 25, 1962) incorporating the changes necessary for identity with WG B Proposal B as modified by X3.2. The revised documents were approved by a majority of the Subcommittee in a written ballot, the results of which are attached.

Absentee Ballots have been sent to Mr. Pivivonsky and Mr. Speilman of X3.2 but their votes are not yet in. However, since a majority has already voted "yes" and since time is of the essence we are submitting to X3 the current results of the balloting.

The current X3 ballot interval terminates June 11, 1962. We understand that some responses have been received, others have not. To enable proper X3 consideration of the revised documents we recommend that the ballot period be extended to a date not later than September 1, 1962. This extension will, we feel, provide adequate time for review of the minor changes made in the proposed code as well as for recognizing the significance of the apparent international consensus developed at the May 4th meeting in Paris. Collection of the results by September 1 will also, we feel, give adequate time to formulate a response to the expected WG B request for opinion on Proposal B due September 15, 1962.

We recognize that it is somewhat unusual to substitute one proposed standard for another prior to completion of the balloting on the first proposed standard. However, in view of the need to respond to Working Group B by September 15 and the significant international accord reached at the Paris meeting, we most strongly urge this step. It is hoped that you will give this proposal your earnest consideration and timely attention.

C. E. Macon
C. E. Macon
Chairman X3.2

CEM/aks

Attch:

X3.2/7
May 25, 1962

WRITTEN BALLOT OF ASA SUBCOMMITTEE
X3.2 - CODED CHARACTER SETS AND DATA FORMATS

This written ballot was authorized this date by the Acting Chairman of ASA Subcommittee X3.2, L. L. Griffin, upon the recommendation of X3.2. A copy of the proposed standard as revised, numbered X3.2/4 and dated May 25, 1962 is attached for reference.

Please indicate your vote below on the question:

> Shall ASA Subcommittee X3.2 recommend to Sectional Committee X3, through the sponsor, the adoption of Proposed American Standard Code for Information Interchange as revised May 25, 1962 in lieu of the X3.2 proposal of the same title dated Nov. 10, 1961?

I vote as follows (YES, NO, or ABSTAIN):

	VOTE	SIGNATURE	DATE	REMARKS
1	Yes	Leon Bloom	5-25-62	
2	Yes	Theodore R. Bousquet	5-25-62	
3	Yes	John F. Chesterman	5-25-62	
4	Yes	John F. Auwaerter	5-25-62	
5	Yes	H. Tholstrup	5-25-62	
6	Yes	L. L. Griffin	5-25-62	
7	Yes	R. E. Utman	5-25-62	
8	No	R. E. Blue	5-25-62	Comments to follow
9	Abstain	A. J. Ungar	5-25-62	To follow
10	Yes	Robert M. Gryb	5-28-62	
13	Yes	C. E. Macon	5-31-62	
11	*	Pivovonsky		
12	*	Spielman		

VOTING INFORMATION

If you find that you cannot vote in the affirmative and desire to be recorded as abstaining from voting or in the negative, please so state and attach an explanation for your position.

American Standards are developed by the voluntary participation of all parties at interest with the intention and expectation that the Standards will be suitable for wide application. Since their use is likewise voluntary, an affirmative vote does not commit an organization or a group represented on the Subcommittee to the use of the American Standard under consideration.

* ballot sent

Received from [illegible]

X3.2/4
May 25, 1962

Rec'd HS Bright
JUL 3 1962

PROPOSED AMERICAN STANDARD CODE
FOR INFORMATION INTERCHANGE

CBI 42/5/12

X3.2/4
May 25, 1962

FOREWORD

(This Foreword is not a part of the Proposed American Standard Code for Information Interchange.)

This American Standard presents the standard coded character set to be used for information interchange among information processing systems, communication systems, and associated equipment.

Subsequent standards will prescribe the means of implementing this standard in the principal media, such as perforated tape, punched cards, and magnetic tape. Other standards will deal with collating and error control considerations. These standards will facilitate the interchange of digital information.

The 7-bit coded character set was developed by a group of highly qualified and experienced specialists in information processing and communication. Historical work in the field was reviewed, and a comprehensive program of original research and code design completed. Careful consideration has been given to the several conflicting code set requirements, and their resolution achieved in the standard code.

This standard was approved as American Standard by the American Standards Association on

Suggestions for improvement gained in the use of this standard will be welcome. They should be sent to the American Standards Association, Incorporated, 10 East 40th Street, New York 16, New York.

CONTENTS

Section	
1	Scope
2	Standard Code
3	Positional Order and Notation
4	Legend
5	Qualifications
Appendixes	

1. Scope

This coded character set is to be used for the general interchange of information among information processing systems, communication systems, and associated equipment.

2. Standard Code

b$_7$				0	0	0	0	1	1	1	1
b$_6$				0	0	1	1	0	0	1	1
b$_5$				0	1	0	1	0	1	0	1
b$_4$	b$_3$	b$_2$	b$_1$								
0	0	0	0	NULL	DC$_0$ ①	ƀ	0	@	P	UNASSIGNED	UNASSIGNED
0	0	0	1	SOM	DC$_1$	!	1	A	Q		
0	0	1	0	EOA	DC$_2$	"	2	B	R		
0	0	1	1	EOM	DC$_3$	#	3	C	S		
0	1	0	0	EOT	DC$_4$ (STOP)	$	4	D	T		
0	1	0	1	WRU	ERR	%	5	E	U		
0	1	1	0	RU	SYNC	&	6	F	V		
0	1	1	1	BELL	LEM	▼	7	G	W		
1	0	0	0	FE$_0$	S$_0$	(	8	H	X		
1	0	0	1	HT/SK	S$_1$	)	9	I	Y		
1	0	1	0	LF	S$_2$	*	:	J	Z		
1	0	1	1	V$_{TAB}$	S$_3$	+	;	K	[		
1	1	0	0	FF	S$_4$	'	<	L	\		ACK
1	1	0	1	CR	S$_5$	—	=	M	]		②
1	1	1	0	SO	S$_6$	.	>	N	↑		ESC
1	1	1	1	SI	S$_7$	/	?	O	←		DEL

3. Positional Order and Notation

Standard 7-bit set code positional order and notation are shown below with b_7 the high-order, and b_1 the low order bit position.

	b_7	b_6	b_5	b_4	b_3	b_2	b_1
Example - The code for "R" is:	1	0	1	0	0	1	0

4. Legend

NULL	Null/Idle
SOM	Start of message
EOA	End of address
EOM	End of message
EOT	End of transmission
WRU	"Who are you?"
RU	"Are you...?"
BELL	Audible signal
FEo	Format effector
HT	Horizontal tabulation
SK	Skip (punched card)
LF	Line feed
V TAB	Vertical tabulation
FF	Form feed
CR	Carriage return
SO	Shift out
SI	Shift in

DC_0	Device control ① Reserved for Data Link Escape
DC_1-DC_3	Device control
DC_4(Stop)	Device control (stop)
ERR	Error
SYNC	Synchronous idle
LEM	Logical end of media
S_0-S_7	Separator (information)
ƀ	Word separator (space, normally non-printing)
<	Less than
>	Greater than
↑	Up arrow (Exponentiation)
←	Left arrow (Implies/ Replaced by)
\	Reverse slant
ACK	Acknowledge
②	Unassigned control
ESC	Escape
DEL	Delete/Idle

Note: Expanded definitions of some of the above terms may be found in appendices.

X3.2/5
May 25, 1962

Rec'd HS Bright
JUL 9 1962

TO: ASA X3 SECTIONAL COMMITTEE

FROM: X3-2 SUBCOMMITTEE

SUBJECT: Expository Remarks on the Proposed American Standard Code for Information Interchange

CBI 42/5/12

X3.2/5
May 25, 1962

TABLE OF CONTENTS

I X3.2 SUBCOMMITTEE REPORT ON THE PROPOSED AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE.

II INTERNATIONAL CONSIDERATION

III COMPARISON OF THE PROPOSED CODE WITH OTHER CODES

IV REMARKS ON DATA TRANSMISSION

V DATA MANIPULATION

VI MEMBERSHIP OF X3.2

VII BIBLIOGRAPHY

X3.2/5
May 25, 1962

SECTION I

SUBCOMMITTEE REPORT ON THE PROPOSED AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE.

1. The X3.2 Subcommittee was assigned the responsibility for developing recommendations for a standard coded character set and recording formats for interchange of information among information processing systems, communication systems and associated equipment. The X3.2 Subcommittee has been making a diligent and determined effort to carry out the assignment. Agreement on a coded character set has been reached within the Subcommittee, and a proposed standard has been forwarded to X.3 Committee. Task Groups have been formed to investigate the application of the coded character set to the principal input/output media (magnetic media, perforated unit documents and continuous perforated media) and to recommend standards on data formats for these media.

2. Membership on the X3.2 Subcommittee is open and includes representation from the data processing industry, the communications industry, and the United States Government. The coded character set recommended by the Subcommittee is intended to serve the needs of the communications industry, the data processing industry and others, for information interchange purposes.

3. Redundancy bits for error control purposes are not included in the standard code.

4. The Draft Standard code set may, for convenience in discussion, be considered subdivided into eight columns of sixteen characters each. Any one of the eight columns can be completely identified by the three high order (left/most) bits.

. The Subcommittee attempted for a number of months to develop a six bit, 64 combination character set that would satisfy both data processing and communication requirements without resort to mode shift characters. However, the number of characters needed in many data processing systems approaches the limit of a six bit set without including many of the control characters essential for communication purposes. The need for format control characters, such as carriage return, line feed, etc., are fundamental to operation of teleprinter communication terminals. Control characters for starting and stopping various devices, such as perforated tape readers and punches and page teleprinters, when used in combination to generate and process information are growing in importance. There is a greater need for transmission control characters since the transmission systems are more automatic in operation. Finally, computer designers prefer to group characters in the code set so as to permit easy separation from control characters which serve no function within the computer. They are also most concerned with the order in which characters are arranged in the code structure, since ordering information in desired sequence is a major function of data processing systems.

6. Such considerations led the Subcommittee to a larger (seven bit) code set providing 128 combinations. This character set contains a graphic subset adequate for both data processing and communication purposes. The character set also provides control characters for use in controlling transmission terminal equipment and input/output devices, information separators for segregating and formating data, and selected characters for special purposes as discussed later in this report.

7. The subcommittee recognizes that computer manufacturers are unlikely to design computers that use 7 bit codes internally. They are more likely to use 4 bit, 6 bit,

8 bit codes. There is no widespread need at present for interchange of more than 128 separate and distinct characters between computers, and between computers and associated input/output equipment. However, an eight bit code structure does have distinct advantages in that two 4 bit numeric characters can be packed into a 8 bit frame. Larger code sets reduce the number of multi-character symbols required for problem definition and programming.

8. The Subcommittee concluded that a set larger than seven bits should not be recommended as a standard. Some of the primary factors which led to this conclusion were:

a. The 128 combinations available in a seven bit set satisfy the information and control interchange requirements for the large majority of users.

b. Utilizing an eight bit set which provides 256 combinations would require recording and transmission of eight bits by all input/output and transmission systems even though the great majority of requirements are satisfied by a code of fewer bits.

c. A redundancy (parity) bit is employed in most read-write operations and may be used in transmission of data for error control purposes. Eight bits (seven code bits plus one redundancy bit) are the maximum that can be recorded in a single frame or character position on one inch perforated paper tape under present recording practices.

9. The coded character set proposed by the X3.2 Subcommittee has been structured to provide such features as the following:

a. A six bit graphic subset containing a monocase alphabet, numerals, the punctuation symbols found on most typewriters, and selected special symbols. The graphic subset is free of control characters, and all combinations within this subset are valid characters. This condition is desirable in information processing since it permits bit manipulation without continuous monitoring for control or invalid combinations. The characters and symbols contained in the graphic subset have been selected to satisfy the needs of both the information processing and communications industry.

b. Within the six bit graphic subset, an identifiable and easily accessible four bit set containing the numerals and symbols frequently used in numeric data processing systems.

c. Control characters segregated from the graphic subset that are generally required for formating information on communication system printers and other teleprinter-like recording devices; for controlling multiple tape reader/recorders and typewriters in information processing and for remote interrogation and control of transmission terminal equipment.

d. Information separators to separate such entities as words, items and records in the systems where special characters are needed for such separation. Eight codes have been assigned as information separators. It is envisioned that the eight separators will be utilized in hierarchical relationship. The Subcommittee did not see fit to give names to individual separators, since such words as "item," "record," "message," etc., have different meanings in different environments.

e. The lowest position (all zeroes combination) of the set has been designated as a "Null" character. In some synchronous transmission systems this combination is transmitted repeatedly during idle periods of no traffic in order to maintain synchronism between sending and receiving terminals. This character may also serve as a "break" function to interrupt a remote transmitter on some types of transmission channels. The "Null" character may, or may not, be transmitted across an interface in a communication system.

f. An "Escape" function in the standard set to facilitate interchange of information in other than the standard code form when circumstances so dictate. Examples are:

(1) Encrypted texts of messages,

(2) Random bit stream types of transmission,

(3) Escape combined with one or more following characters for special function purposes.

g. A "Delete" function to erase information previously recorded or transmitted. Primarily, needs are for deleting operator mistakes, machine malfunctions, and characters garbled in transmission. Since complete erasure can be accomplished in perforated tape systems only by perforating all levels, this dictated assignment of this function to the all ones combination. This character may also be used as an "Idle" function for transmission channel holding or "fill in" purposes. The "Delete" character may, or may not, be transmitted across an interface in a communication system.

10. The characters in the graphic subset include (in addition to a monocase alphabet and ten numerals) a word separator or "space," and a selection of punctuation and special symbols considered by the Subcommittee to be most useful for general communications and data information interchange purposes. The subset includes the characters specified for Common Business Oriented Language (COBOL) programming.

11. The placement of characters and character groups within the set is a matter to which the Subcommittee has devoted a great deal of its effort. Placement of characters within the graphic subset was influenced by the requirements for ordering information in data processing operations (sorting, merging, comparing,

ting, etc.), the construction of keyboard devices, and requirements of simply lated 6-bit sets. For data processing, it is desirable that the characters be arranged in such a way as to minimize the operating time and hardware components required for ordering and sequencing operations. To avoid detailed examination of individual characters in computers and to perform sort/collate functions with a minimum need for exceptional treatment of characters, great emphasis is placed on the grouping of characters in the character set, and the relative order of characters within each grouping. The proposal of the Subcommittee is a compromise reached in view of several conflicting requirements.

Keyboard design requires a character arrangement that minimizes equipment costs. It is also deemed desirable that the keyboard depart as little as practical from the keyboard arrangement to which trained typists are accustomed in the United States.

Other factors which influenced to some extent the character placement in the information subset were:

a. The historic arrangement of information in a large percentage of existing files in data processing centers.

b. Arrangements which were considered to enhance the international acceptability of the character set such as (1) the need in some foreign countries of an alphabet of more than 26 letters; (2) the need to provide for the digits 10 and 11 in the Sterling monetary areas and (3) standards adopted or being considered in foreign countries and in the International Standards Organization. Specifically the alphabet and the numerals 0 through 9 have been located in the same position within columns as in the code sets contained in Resolution 1 agreed to at the ISO/TC97 Working Group B meeting of May 2-4, 1962.

c. The existing Department of Defense Military Standard 8-level code (Fieldata).

12. The code set places the word separator (space) low, or first, in the information subset; an "A" followed by a "Space" would be collated lower than "AA" or "AB"; a value "2" lower than "22", etc. Some punctuation symbols perform similar functions and are also placed lower than numerals and letters. The numerals are located lower than the alphabet. In those cases where, for historical reasons, numbers are to be collated higher than alphabetic characters, the entire numeral column of 16 characters can be reotated via relatively simple computer logic to a position higher than the alphabet. The special characters in this column following the numbers have been selected to satisfy various requirements and because historically they have had little significance in information collating.

13. The historic and logical use of the all-zeroes (Null) and all-ones (Delete) codes for control purposes excludes them from the graphic set and confines the graphic set to the interior six columns. The symmetry to be gained by placement of the graphic set in the middle four columns minimizes the problems of distinguishing between controls and graphics.

14. The controls selected, generally fall into 4 groups: (1) transmission controls, (2) format effectors, (3) device controls and (4) information separators. Within each group the controls are ordered so that the binary and hierarchical order are directly related.

This structure facilitates the contraction of the standard to related 6-bit sets and permits logical comparisons of related controls in the ordering of information. In particular, the placement of the format effectors and information parators facilitates their dual usage when contracting to related 6-bit sets.

The "ESCAPE" character was placed for compatibility with the equivalent "SPECIAL" character of the DOD Military Standard 8-level code (Fieldata). The "Acknowledge" function was placed for ease of generation with a simple electromechnical device (a single transition between consecutive zeroes followed by consecutive ones).

15. The Subcommittee has attempted to group characters and character subsets in a useful and logical order. This grouping is designed to facilitiate manipulation of data groups within the proposed set as well as for ease of expansion of the seven bit set into larger sets and contraction of desired characters into a smaller set. Insofar as practical, the code set was constructed such that an entire 16 character group or multiples of such groups would be operated on when expanding to, and contracting from, larger and smaller sets. For example, many contemporary data processors and associated input/output equipment employ a 6-bit coded character set, exclusive of error control redundancy. The 64 character information subset contained in the middle columns of the proposed set can be transformed into a six bit set in which the relative order of columns is maintained.

16. The Subcommittee recognizes that requirements exist that will require substitution of characters for those specified in the proposed standard. Substitution in the following areas will cause a minimum disruption of interchange compatibility:

a. The five positions following the letter "Z"

Examples: Extension of the alphabet where more than 26 letters are required.

Substitution of a "DELETE" control character in the last position, when required in a 6-bit character set.

b. The unassigned portions of the last two columns, Example: The use of this area for a second alphabet, placing each letter in the same relative position as its counterpart in the graphic set.

c. The "Escape" codes and mode shift (shift-out, shift-in) characters are means of deviation from the proposed character set.

17. The Subcommittee recognizes the widespread employment of a parity bit on each character code for error control purposes. The proposed set has been designed to permit the use of either "odd" or "even" parity interchangeably as dictated by recording media and systems requirements.

SECTION II

INTERNATIONAL CONSIDERATION

1. Basic to the Committees knowledge and consideration of international code activities has been the information and resources available through members by virtue of their qualifications, experience, and affiliations.

2. From the start of the X3.2 activity members have corresponded with various people in the data processing and communications field in Europe. Among those contacted in Europe are:

J. Besseyre - CCITT
A. Curnow - NCR, BSI, ECMA TC-1
L. Durand - Bull, ECMA TC-1
W. Eadie - IBM United Kingdom Ltd., BSI, ECMA TC-1
R. Gottlieb - Olivetti
Dr. Kaiser - Standard Elektrik Lorenz (ITT)
Dr. Lockemann - Siemens, Chairman ECMA TC-1
Dr. Neubauer - Standard Elektrik Lorenz (ITT)
H. McGregor Ross - Ferranti Ltd., BSI, ECMA TC-1
H. Wusteney - Siemens
Dr. Zannini - Olivetti

3. The proposed American Standard Code for Information Interchange takes into consideration the European placement of the alphabet and allows for inclusion of three additional letters for the Scandinavian alphabets and for extension to 10 and 11 for a duo-decimal number system.

4. There was initial personal contact with European code interests beginning at the time of the IEC/TC 53 meeting in London by two members of X3.2. Subsequently (January, 1962) two other members personally visited most European interests to lay the basis for mutual understanding of code activities.

5. A delegation from X3.2 attended the ECMA TC-1 meeting of March, 1962 at which time the positions of ASA X3.2 and ECMA TC-1 were reviewed. A 7-bit set

and related 6-bit set were structured for subsequent (independent) study by the two committees.

6. A U.S. delegation (members of X3.2) attended the ISO TC/97 Working Group B meeting Number 2 of May, 1962. The meeting resulted in a resolution requesting of the principal members of WG B their opinion for or against a particular 7-bit set and a related 6-bit set.

7. A U.S. delegation will participate in the ISO TC/97 WG B meeting Number 3 in October, 1962.

X3.2/5
May 25, 1962

SECTION III

COMPARISON OF THE PROPOSED STANDARD CODE WITH OTHER CODES

On the following pages, the Proposed American Standard Code for Information Interchange is compared with several codes which are representative of the codes in wide usage.

COMPARATIVE CODE STRUCTURES

PROPOSED AMERICAN
STANDARD CODE FOR
INFORMATION INTERCHANGE

NULL	①DC$_0$	ƀ	0	@	P	UNASSIGNED	UNASSIGNED
SOM	DC$_1$	!	1	A	Q		
EOA	DC$_2$	"	2	B	R		
EOM	DC$_3$	#	3	C	S		
EOT	DC$_4$ (STOP)	$	4	D	T		
WRU	ERR	%	5	E	U		
RU	SYNC	&	6	F	V		
BELL	LEM	'	7	G	W		
FE$_0$	S$_0$	(	8	H	X		
HT/SK	S$_1$	)	9	I	Y		
LF	S$_2$	*	:	J	Z		
VT	S$_3$	+	;	K	[		
FF	S$_4$	,	<	L	\		ACK
CR	S$_5$	–	=	M	]		②
SO	S$_6$	.	>	N	↑		ESC
SI	S$_7$	/	?	O	←		DEL

① RESERVED FOR DATA LINK ESCAPE
② UNASSIGNED CONTROL

ISO
TC/97
WG8
(PROPOSAL B)
(RELATED 6-BIT SET)

ƀ	0	NULL @	P
HT	1	A	Q
NL	2	B	R
VT	3	C	S
FF	4	D	T
F$_5$	5	E	U
SO	6	F	V
SI	7	G	W
(	8	H	X
)	9	I	Y
:	*(10)	J	Z
;	+(11)	K	①([)
,	$(<)	L	①(\)
–	%(=)	M	①(])
.	&(>)	N	ESC
/	'	O	DEL

① SCANDINAVIAN EXTENSION

BSI ①

SP	0		P
	1	A	Q
NL	2	B	R
PT	3	C	S
HT	4	D	T
BS	5	E	U
SO	6	F	V
SI	7	G	W
(	8	H	X
)	9	I	Y
	10	J	Z
£	11	K	
		L	
&	+	M	
*	–	N	ESC
/	.	O	DEL

① ACCORDING TO INFORMATION AVAILABLE DEC.1961

DOD MIL STD
8-LEVEL CODE
(FIELDATA)

CONTROL (NOT DEFINED)	MS	K	)	0
	UC	L	–	1
	LC	M	+	2
	LF	N	<	3
	CR	O	=	4
	SP	P	>	5
	A	Q	—	6
	B	R	$	7
	C	S	*	8
	D	T	(	9
	E	U	=	'
	F	V	:	;
	G	W	?	/
	H	X	!	.
	I	Y	,	SPEC
	J	Z	STOP	IDLE

IBM BCD
INTERCHANGE CODE

BL	ƀ	–	&+
1	/	J	A
2	S	K	B
3	T	L	C
4	U	M	D
5	V	N	E
6	W	O	F
7	X	P	G
8	Y	Q	H
9	Z	R	I
0	‡	!	?
#=	,	$	.
@'	%(	*	⌑)
:	⋎	]	[
>	\	;	<
√	⧻	△	ǂ

‡ RECORD MARK
√ TAPE MARK
△ MODE CHANGE
ǂ GROUP MARK
⋎ WORD SEPARATOR
ƀ SUBSTITUTE BLANK
BL BLANK
↑ [illegible]MENT

CCITT #2

FIGS		LTRS	
NA	5	NA	T
3	+	E	Z
LF	)	LF	L
–	2	A	W
SP	(DV)	SP	H
1	6	S	Y
8	0	I	P
7	1	U	Q
CR	9	CR	O
WRU	?	D	B
4	(DV)	R	G
BELL	FIGS	J	FIGS
,	.	N	M
(DV)	/	F	X
:	=	C	V
(	LTRS	K	LTRS

(DV) DOMESTIC VARIATION

SET CONTENT

GRAPHIC COMPARISONS

OSED RICAN ANDARD ODE FOR ORMATION ERCHANGE	ISO TC/97 WGB (PROPOSAL B)	B.S.I.	DOD MIL-STD 8 LEVEL CODE (FIELDATA)	IBM BCD INTERCHANGE CODE	SHARE	TYPICAL FLEXO-WRITER (IBM)	CCITT #2	TWX	COBOL	ALGOL
A - Z	X	X	X	X	X	X	X	X	X	X
0 - 9	X	X	X	X	X	X	X	X	X	X
ƀ	X	X	X	X	X	X	X	X	X	
!			X	X						
"			X					X	X	
#				X						X
$	X		X	X	X	X		X	X	
%	X			X						
&	X	X		X		X		X		
'	X			DUAL W/@	X		X	X		
(	X	X	X	DUAL W/%	X		X		X	X
)	X	X	X	DUAL W/¤	X		X		X	X
*	X	X	X	X	X				X	
+	X	X	X	DUAL W/&	X		X		X	X
,	X		X	X	X	X	X		X	X
−	X	X	X	X	X	X	X	X	X	X
.	X	X	X	X	X	X	X	X	X	X
/	X	X	X	X	X	X	X	X	X	X
:	X		X	X			X			X
;	X		X	X		X			X	
<			X	X					X	X
=			X	DUAL W/#	X		X		X	X
>			X	X					X	X
?			X	X			X			
@				X						
[				X						X
\				X				X		
]				X						X
↑										X
←										
NOT IN PROPOSED ASCII SET	Å Ø Æ	£ 10 11	—	¤			(THREE POSITIONS RESERVED FOR DOMESTIC VARIATION)	1/4 3/8 1/2 5/8 3/4		a - z := 10 · , × ÷ ≤ ≥ ≠ ¬ ∧ ∨ ≡ ⊃

SET CONTENT

CONTROL COMPARISONS
(EXACT EQUIVALENT IS NOT IMPLIED)

SED RICAN NDARD DE FOR FORMATION TERCHANGE	ISO TC/97 WGB (PROPOSAL B)	B.S.I.	DOD MIL-STD 8 LEVEL CODE (FIELDATA)	IBM BCD INTERCHANGE CODE	SHARE	TYPICAL FLEXO-WRITER (IBM)	CCITT # 2	T W X	COBOL	ALGOL
FF	X	X				X				
CR			X			X	X	X		
LF	X	X	X				X	X		
SO	X	X	X			X	X	X		
SI	X	X	X			X	X	X		
H TAB/SKIP	X	X				X				
/ TAB	X									
FE_0										
DC_0						X				
DC_1						X				
DC_2						X				
DC_3						X				
)C_4 (STOP)			X			X		X		
ERROR						X				
SYNC										
SOM										
EOA										
EOM						X				
EOT										
WRU							X	X		
RU										
S_0				X	X	X				
S				X	X	X				
S_2				X	X	X				
S_3				X	X	X				
S_4				X	X	X				
S_5										
S_6										
S_7										
ACK										
ESC	X	X	X							
LEM										
DEL	X	X	X			X				
NULL	X			X			X	X		
BELL							X	X		
NOT IN PROPOSED ASCII SET	BACKSPACE	FE_5	MS			BACKSPACE				

MS = MASTER SET

NSLATION - General Remarks

ommunication between systems and devices using the Proposed American Standard and those using other codes is a serious problem that should not, in any way, be minimized. The degree of complexity varies, however, with the particular code set under consideration.

The general term "translation" under discussion includes the process of converting the code associated with a given graphic or control in one set to that associated with the same character in a second set (rearrangement). Since, in many cases, the contents or size of the two sets are not identical, we shall include the concepts of substitution and deletion in addition to rearrangement as part of the process of translation. Substitution is encountered when a character existing in the original set is not found in the final set, and some other character (not in the original set) is used in its place. Deletion is simply elimination of characters when the original set is larger than the final. This latter variable requires that three cases of the translation problem be considered: When the two sets contain the same number of characters; when the original set is smaller than the final set and when the original set is larger than the final set.

As a general rule, the amount of rearrangement determines the complexity of the translation problem. Deletions introduce factors that must be recognized by the user, but they do not usually affect the logic of conversion. The user must take into account the loss of characters inherent in translating from a larger to a smaller set. Substitution is simply a recognition of a character equivalence and thus is more of an operating problem.

A given character common to each set is usually defined by a unique code bit pattern in each set. A series of logical expressions can be written for each character that define how the bits from the original code must be combined to

SECTION VI

MEMBERSHIP OF X3.2

The following is a list of X3.2 members and alternates who were active in and during the formulation of the draft standard code, along with a brief statement of their positions and affiliations:

C. E. Macon - X3.2 Chairman (former Secretary)

Senior Staff Scientist
Manager Advanced Manufacturing, and
Engineering Planning
Electro Data Division
Burroughs Corp.

I. Liggett - former X3.2 Chairman

Formerly Director of Systems Standards
IBM

R. E. Utman - X3.2 Secretary

Manager of Univac Systems Standards
Univac Division
Sperry Rand Corp.
N.Y.C.

J. F. Auwaerter - Director of Product Development
Teletype Corporation

J. B. Booth - Project Director
Research and Development
Teletype Corporation

R. Gryb - Private Line and TWX Engineer
American Telephone & Telegraph Corp.

A. L. Whitman - Member Technical Staff
Bell Telephone Laboratories
(40 years in communications)

L. L. Griffin - Electronic Engineer
Navy Management Office, D.O.D.
(30 years in commercial and military communications, 4 in data processing)

CBI 42/5/12

J. E. Bartelt - Director of Systems Standards
IBM

L. Bloom - Head Formulation Section
Product Specifications Department
Electronics Division
National Cash Register Co.

T. H. Bonn - Chief Engineer for Research and
Peripheral Development
Univac Division
Sperry Rand Corp.
White Plains, Pa.

H. Kleinberg - Manager of Computing Devices Engineering
Electronic Computer Division
R.C.A.

W. J. Leubbert - Associate Professor of Electricity, and
Head of the Computer Laboratory
U. S. Military Academy
West Point, N. Y.
(Original development of Fieldata code)

M. Pivovonsky - Staff Member
Department of Electronic Research and Development
Monroe Calculating Machine Co.

R. W. Reach - Formerly
Staff Engineer
Minneapolis-Honeywell
(MH 800 Logical Design)

H. J. Smith, Jr. - Research Staff Member
IBM Research

H. Tholstrup - Engineer
Friden, Inc.
Commercial Controls Corp.
Chairman of ASA X6 Sectional Committee
EIA Representative to X3

R. E. Blue - Advance Communications Planning
(Chairman of IBM
Coded Character Set
Committee on Standardization)
General Products Division
IBM

A. J. Ungar - Senior Program Analyst
International Electric Corp.
Division of ITT

J. F. Chesterman - Member of Technical Staff
Bell Telephone Laboratories

T. S. Bousquet - Engineer
Engineering and Research Center
EDP Division
Minneapolis-Honeywell

R. W. Bemer - Director of Systems Programming
Univac Division
Sperry Rand Corp.

It should be recognized that although X3.2 members are variously affiliated, work on an ASA subcommittee is achieved primarily on an individual competence and experience basis. The membership above has with some exceptions been continuously active from the beginning of X3.2 work in 1960.

SECTION VII

BIBLIOGRAPHY

Subcommittee X3.2 reviewed and considered much of the available technical literature on character code design for information processing and communications systems in the course of its work in development of the draft standard 7-bit character code. The committee members also contributed many papers available from the company work. Considerable correspondence with European interests also resulted in availability of technical papers on the international code design activity. The following is a partial list of the reference material and reports that X3.2 examined in its work (as gleaned from the X3.2 official minutes):

PR27, 6th Edition, April 5, 1960

"The organization and work of Sectional Committees operating under the Constitution, By Laws and Procedure of the American Standards Corporation, Incorporated."

"A Short Study of Notation Efficiency," - by H. Smith of IBM.
"On Data Format Standardization," - by H. Smith of IBM.
"On Character Set Standardization," - by H. Smith of IBM.
Minutes of ASA General Conference of January 3, 1960.
ASA Sectional Committee Meeting of August 4, 1960, Agenda and Minutes.
Grems-Mullery Report - "Analysis of ASA X3 Project".
"A Survey of Coded Character Representation" - by R. W. Bemer of IBM. (Complete with chart of codes for various machines.)

"Fieldata Equipment Intercommunication Characteristics," memorandum for: Director, Data Processing, Facilities Division, Communications Department, USASRDL of April 1959 (Rev. August 1, 1959).

"Proposed Addendum to Section 3 of MILSTD-188A," - supplied by Mr. Griffin, Navy Department.

"Random Thoughts on Characters and Set Sizes," - by H. Smith of IBM.
"Remarks on Blank, Null and Idle," - by H. Smith of IBM.
"McElroy Report" - from H. Tholstrup (12/2/60).
"Characters and Symbols Used in Business" - from L. Bloom (12/2/60).
"Special characters for Engineers and Science" - from R. Reach (12/2/60).
"Character Sets for COBOL and ALGOL" - from T. H. Bonn (12/2/60).
"Desirable symbols for Mathematics" - from H. Smith (12/2/60).
"Analysis of chart six-bit codes versus symbols" - from H. Smith (12/2/60).
"Character Sets for NCR Equipment Codes" - from L. Bloom (12/2/60).
"Bendix G-15 and G-20 Character Codes" - from C. Macon (12/2/60).
"Punctuation Requirements" - report of E. C. Olofson, Royal McBee Corp. (12/2/60).
"Symbols Which Would be Included for Data Control and Machine Control" - report of L. J. Schoenberg (12/2/60).

"Do it by Numbers -- Digital Shorthand" - by R. W. Bemer.
"Proposed Six Unit Code for Teletypewriter and other Data Communication to Operate with 4 Row Electric Typewriter Keyboard - December 19, 1960" - from A. Whitman (1-16-61).
"EIA Standards Proposal for One Inch Perforated Paper Tape" - from EIA.
"EIA Tentative Standards Proposal for Eleven-sixteenths Inch Wide Five-Track Perforated Paper Tape" - from EIA.
"AIEE Standard for Perforated Tape (Preliminary)" - from AIEE.
"On the Design of Extended Character Sets" - by R. W. Bemer.
"Design of an Improved Transmission/Data Processing Code" - by Bemer, Smith, and Williams of IBM.
"Information Handling and Processing in Large Communication Systems" - by W. F. Luebbert.
"Further Survey of Punched Card Codes" - by H. McG.-Ross, Ferranti Ltd. London.
"Considerations in Choosing a Character Code for Computers and Punched Tapes" - by H. McG-Ross, Ferranti Ltd., London.
"Philosophy of Structuring a Family of Coded Character Sets" - draft report by H. Smith of IBM.
"Report on EIA Survey of Information Processing"-from EIA.
"An 8-Bit Code Set Structure" - by J. F. Auwaerter of Teletype.
D.O.D. "Military Standard 188A (Fieldata)".
"Processor Control Characters" - from X3.2 (8-31-61).
"8-Bit Set Processor Oriented" - by H. Smith - IBM.
"8-Bit Set" - by H. Smith of IBM.
"Error - Detection System for 5 Unit Code Teletypewriter Transmission" - from X3.2 (8-31-61).
"Chart-Analysis of Typewriter Keyboards" - from H. Smith of IBM.
ASA "Style Manual" - PM117a, January 1960.

This list in no way should be considered an exhaustive bibliography of technical literature available to X3.2 in its design of the draft standard code. Individual members, for instance, maintain their own personal libraries, or referred to company libraries, in support of the considerable effort that has gone into this code design.

Md.

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New Britain

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X3.2/4
y 25, 1962

Rec'd H S Bright
JUL 1962

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ISO
INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
ORGANISATION INTERNATIONALE DE NORMALISATION

ISO/TC 97/WG B
CHARACTER SETS AND CODING
Secretariat :
FRANCE

ISO/TC 97/WG B
(Sec.4)15 E
June 1962

To : - all members of WG B for consideration and reply
- ECMA and UIC, for information

STUDY BY ISO/TC 97/WG B OF TWO PROPOSED 7-BIT CODED SETS WITH RELATED 6-BIT CODED SETS

QUESTIONNAIRE *

Gentlemen,

During its May meeting in PARIS, the ISO/TC 97/WG B agreed the absolute need for an urgent choice if the study of the coded sets now started is to be carried on until final approval.

Resolution 1 here after gives necessary information on the matter. It mentions two proposals A and B, the second one being preferred by a majority of the delegations present at the PARIS meeting.

In order to comply with resolution N° 1, the member bodies are requested to send their opinions to the secretariat for or against proposal B by 15th September, 1962 (at the latest on account of the October meeting).

Sincerely yours
THE GENERAL MANAGER

J.BIRLE

Appendixes :

Resolution 1
Notes
Tables A and B Six-bit
Tables A and B Seven-bit
Abreviations

*URGENT : Answer requested by September 15th at the latest

Arc. : 856 E

NMAH 310/3

APPENDIX

RESOLUTION 1

The Working Group decides that the analysis given in document 14 (with the addition of 4th May), together with the table put on the board during 4t May should be presented together and sent to all member bodies of the W.G., as soon as possible.

These tabulations are referred to as A and B.*

Both proposals A and B are seven-bit coded sets with a related 6-bit coded set, but B which is preferred by a majority of the delegations present at the meeting results from compromises made by several delegations.

The W.G. requests its P. members to send their opinions to the secretariat for or against proposal B by 15th September 1962.

---

* See tables of the following pages

A

ISO/TC 97 GT. B - 3 et 4 Mai 1962

Ⓐ 6 Bit Coded Set - Code à six moments

	00	01	10	11
0000	NULL	0	UNASSIGNED	P
0001	F_4 (FF)	1	A	Q
0010	F_3 (VT)	2	B	R
0011	F_2 (NL)	3	C	S
0100	F_1 (HT)	4	D	T
0101	SPACE	5	E	U
0110	SO	6	F	V
0111	SI	7	G	W
1000	(	8	H	X
1001	)	9	I	Y
1010	:	10 or *	J	Z
1011	;	11 or +	K	① or [
1100	, (Comma)	③ Cur. Sign or <	L	① or \
1101	-	③ % or =	M	① or]
1110	.	③ & or >	N	ESCAPE
1111	/	' (Apostr.)	O	DELETE

① cf. Note 1
③ cf. Note 3

A

ISO/TC 97 GT.B – 3 et 4 Mai 1962.

Ⓐ 7 Bit Coded Set – Code à 7 moments

	000	001	010	011	100	101	110	111
0000	NULL	UNASSIGNED	SPACE	0	@	P	UNASSIGNED	UNASSIGNED
0001	TC_4 (EOT)	DC_4 (STOP)	!	1	A	Q		
0010	TC_3 (EOM)	DC_3	"	2	B	R		
0011	TC_2 (EOA)	DC_2	#	3	C	S		
0100	TC_1 (SOM)	DC_1	② $	4	D	T		
0101	WRU	ERROR	② %	5	E	U		
0110	RU	SYNC	② &	6	F	V		
0111	BELL	EOB	② ' (Apostr.)	7	G	W		
1000	UNASSIGNED	S_5 (LEM)	(	8	H	X		
1001	FE_4 (FF)	S_4	)	9	I	Y		
1010	FE_3 (VT)	S_3	:	*	J	Z		
1011	FE_2 (LF)	S_2	;	+	K	① [		
1100	FE_1 (HT)	S_1	, (Comma)	② <	L	① \		
1101	CR	S_0	-	② =	M	①]		
1110	SO	UNASSIGNED	.	② >	N	↑		ESCAPE
1111	SI	UNASSIGNED	/	② ?	O	←		DELETE

② cf. Note 2

B

ISO/TC 97 GT.B - 3 et 4 Mai 1962

Ⓑ 6 Bit Coded Set - Code à six moments

	00	01	10	11
0000	SPACE	0	NULL	P
0001	F_1 (HT)	1	A	Q
0010	F_2 (NL)	2	B	R
0011	F_3 (VT)	3	C	S
0100	F_4 (FF)	4	D	T
0101	F_5	5	E	U
0110	SO	6	F	V
0111	SI	7	G	W
1000	(	8	H	X
1001	)	9	I	Y
1010	:	10 or *	J	Z
1011	;	11 or +	K	① or [
1100	, (Comma)	③ Cur. Sign or <	L	① or \
1101	-	③ % or =	M	① or]
1110	.	③ & or >	N	ESCAPE
1111	/	' (Apostr.)	O	DELETE

① cf. Note 1
③ cf. Note 3

B

ISO/TC 97 - 3 et 4 Mai 1962

Ⓑ 7 Bit Coded Set - Code à 7 moments

	000	001	010	011	100	101	110	111
0000	TC_0 (NULL)	DC_0	SPACE	0	Y @	P	UNASSIGNED	UNASSIGNED
0001	TC_1 (SOM)	DC_1	!	1	A	Q		
0010	TC_2 (EOA)	DC_2	"	2	B	R		
0011	TC_3 (EOM)	DC_3	#	3	C	S		
0100	TC_4 (EOT)	DC_4 (STOP)	② $	4	D	T		
0101	TC_5 (WRU)	ERROR	② %	5	E	U		
0110	TC_6 (RU)	SYNC	② &	6	F	V		
0111	TC_7 (BELL)	EOB	② ' (Apostr.)	7	G	W		
1000	FE_0	S_0	(	8	H	X		
1001	FE_1 (HT)	S_1	)	9	I	Y		
1010	FE_2 (NL)	S_2	:	*	J	Z		
1011	FE_3 (VT)	S_3	;	+	K	① X [		
1100	FE_4 (FF)	S_4	, (Comma)	② <	L	① X \		
1101	FE_5 (CR)	S_5	-	② =	M	① X]		
1110	SO	S_6	.	② >	N	X ↑		ESCAPE
1111	SI	S_7	/	② ?	O	X ←		DELETE

② cf. Note 2

NOTE 1

The positions indicated by ① are reserved for the alphabetical characters of those countries where the alphabet includes more than 26 letters. The symbols [\ ] are recommended substitutions in those countries in which the alphabet is up to 26 letters.

NOTE 2

Consideration shall be given in the 7-bit set to exchanging the characters in the table with the characters as listed below :

$ with <
% " =
& " >
' " ?

NOTE 3

When collapsing from the 7-bit set into the 6-bit set a choice may be made on which characters to insert in the positions marked with footnote 3 depending upon whether the application is business or scientific, as follows :

Business		Scientific
or $ or currency sign	or	<
%	or	=
&	or	>

JEA 6/67

Initial

Proposal regarding an extended telegraph code

Committee No. VIII of the C.C.I.T.T. has been engaged for several years with the development of a new telegraph code. These studies have been initiated when it was found desirable to have teleprinters print lower case and upper case letters as with ordinary office machines and to afford a larger choice of national letters and other extra characters than has been available in the past. In the meantime these problems have been somewhat relegated to the background in view of the urgent need for a telegraph code which would also permit the transmission of data in data processing systems.

It appears necessary, before dealing with a proposal for such a telegraph code, to study the requirements arising in the various fields of application.

I. In telegraphy:

1. The new code should be free from the difficulties which are due to the low capacity of the international telegraph code No. 2. This implies that more code combinations must be available for national letters, symbols, and function control signals.

am 1H
30/3

4. During operation with the equipment to be provided along with the new code it will frequently happen that 8-level perforated tape supplied by data processing equipment (such as Flexowriters) has to be transmitted. Likewise, it might frequently be necessary to check the dependability of terminal equipment and transmission gear by adding a parity check character.

It follows that the send and receive sides of the machines, intended to satisfy the increased demands, have to be designed for eight code elements per signal. It should be noted that in the USA networks have already been installed which permit customers to send and receive 8-level tape.

5. The CCITT itself has stated that a direct cooperation between machines operating with an extended telegraph code and machines operating with the international telegraph code No. 2 is not feasible. In telegraphy, the various characters can therefore be freely assigned to the available code combinations, without regard to existing rules.

An exception to this is the sequence consisting exclusively of start-polarity elements which should remain unassigned as it may cause the release of a circuit in certain switching systems.

The design of the typing unit must not be complicated. This can be achieved by arranging the characters to be printed so that not all of the 8 code elements must be interpreted in the typing unit but only 6, if possible.

Besides, the figures 0 to 9 should be assigned, as far as possible, symbols on the same keys with a shift key provided for selection.

In those cases where they are required, the National signals take the place of the adjacent mathematical symbols.

4. The first zone contains only function signals, to be more precise, those function signals which may be expected to be used by all types of page-printers (WRU and Bell), signals controlling extras (VT, Xon, Xoff, Ron, Roff), and signals required by switching facilities (SOM, EOA, EOM, EOT and RU), as well as the COS signal. Capacity is left for two further functions next to COS.

   The combination 0000000 must remain unassigned for the reason given under I.5, 2nd paragraph.

5. Functions required also in data processing are accommodated in the last four zones (Escape, HT, LF, FF, CR).

6. The "delete" signal is used for cancelling errors. The same code combination and "Null" form the two idle signals for synchronous operation.

7. "Escape" is a shift signal which permits all code combinations to be used for other purposes. It must not be used for printed characters and influences only the next one of the following code combinations.

8. For upper case and lower case letter printing the zones 3 and 4 are also used. The typing unit then covers a range of 6 zones.

9. In data processing the last 4 zones form a complete 6-unit code. This is derived from the 7-unit code by omitting the 7th code element. It can be supplemented to form a 7-unit code by adding the 7th signal element which is invariably "1". The requirement for compatibility is in this way fully complied with.

Annex 1

Tableau de code à 7 éléments d'information

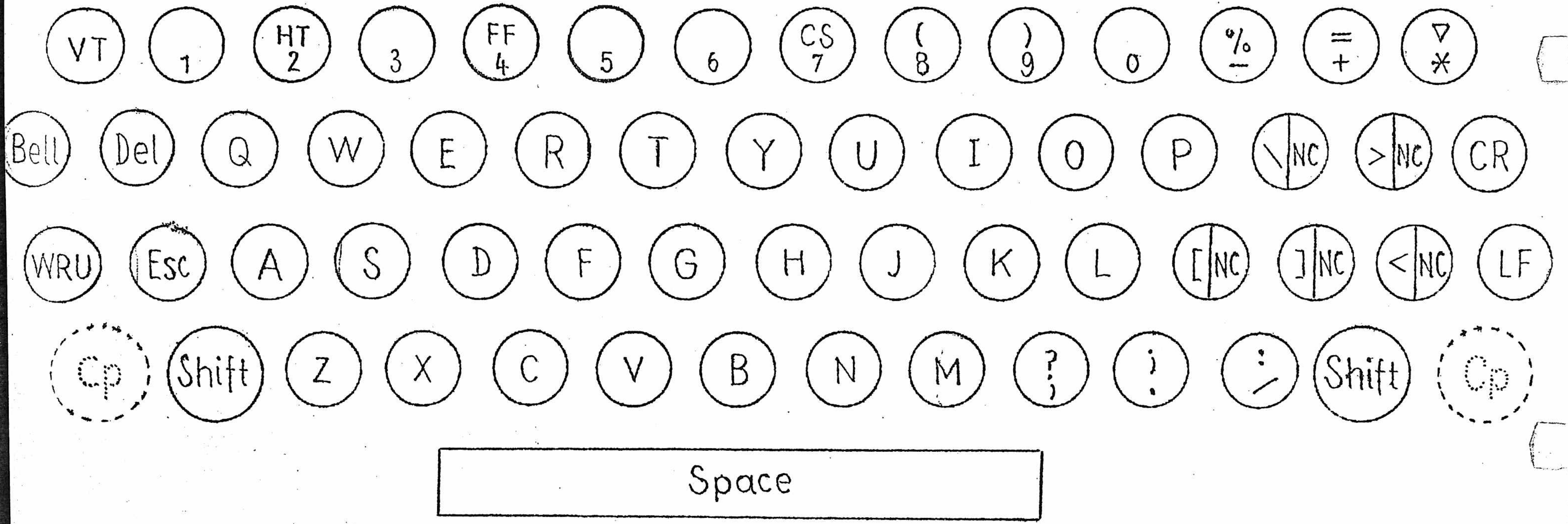
Table of the 7 bit code

$b_7\ b_6\ b_5$

$b_4\ b_3\ b_2\ b_1$	000	001	010	011	100	101	110	111
0000			A	Q	Null	0	a	q
0001	SOM		B	R	Space	1	b	r
0010	EOA		C	S	HT	2	c	s
0011	EOM		D	T	LF	3	d	t
0100	EOT		E	U	FF	4	e	u
0101	X on		F	V	CR	5	f	v
0110	X off		G	W	Escape	6	g	w
0111	R on		H	X	CS	7	h	x
1000	R off		I	Y	(	8	i	y
1001	W RU		J	Z	)	9	j	z
1010	RU		K	Nat. Capitals	▽	*	k	Nat. Charact. [
1011	Bell		L		=	+	l	\
1100	VT		M		?	,	m	]
1101	COS		N		%	–	n	>
1110			O		;	.	o	<
1111			P		:	/	p	Delete

Annex 3

Clavier
Keyboard



R. E. Utman - New York

E. H. Clamons

Blue Bell - June 12, 1962

Product Planning

R. W. Bemer - New York
W. R. Lonergan - New York

PROPOSED BEMA STANDARD CODE
FOR INFORMATION INTERCHANGE X3.2

You are hereby directed to vote "no" on the proposed BEMA Standard Code for information interchange. The reasons for the vote of "no" are as follows:

1) The position of the control functions, data delimiters and special symbols of the BEMA proposed Standard do not agree with those obtained from the I.S.O. working group B, thus there is a lack of compatibility between the proposed International Standard and the proposed American Standard.

2) The period and comma should be interchanged. The period is commonly used in abbreviations and at the end of a sentence. It generally means nothing follows. The comma, however, is used in programming as a data delimiter, meaning more follows and therefore it must collate lower than the period.

3) Two of the data delimiters can not be folded into the six-bit subset without losing the left and right parenthesis or the 8 and 9 numerics or alphabetics. These data delimiters are the 001 1000 and 001 1001.

4) The absence of a delete or escape in the six bit data processing set could in general cause serious ramifications.

5) The lack of data delimiters in the data processing set is another problem which could cause serious economic ramifications.

6) The rules for folding have not been defined in either the specification or the attached supplements. It is felt that this is a serious omission, and that one must know these rules before one can properly use the proposed Standard.

EFV:EHC:aj

E. H. Clamons

NMAH 310/3

Data Processing Group

bema

Business Equipment Manufacturers Association
235 East 42nd Street, New York 17, New York — MUrray Hill 7-5969

ASA Subcommittee X3.2 - Character Sets and Data Format

MINUTES

Meeting #20 of June 27 and 28, 1962
BEMA Headquarters, New York, N.Y.

SUMMARY

Mr. J. F. Auwaerter was appointed as the X3.2 representative on the X3 International Advisory Committee. Mr. Booth reported that the assignment of the SYNCH character and the reservation of a position (0010000) for Data Link Escape in the proposed ASCII was accepted by X3.3 as a satisfactory compromise to meet the needs of synchronous data transmission. A motion that X3.2 activity be extended to include preparation of a parallel standard code for punched cards, as proposed in a letter presented by R. E. Blue, was made, discussed at length, and defeated by a majority vote. Assignments were made for the preparation of rebuttals to position papers on the proposed ASCII, so that final replies to these position papers can be agreed upon at the next meeting of X3.2, scheduled to be held in Los Angeles on July 25 to 27, 1962.

APPENDICES

A. Membership Status and Attendance
B. Agenda - Meeting June 27-28, 1962

R. E. UTMAN
AUG 23 1962
BEMA/DPG

NMAH
310/3

X3.2 Subcommittee on Character Sets and Data Formats
of the American Standards Association X3 Sectional
Committee Sponsored by BEMA

MINUTES

Meeting of June 27 and 28, 1962
Held at BEMA Headquarters, New York, N. Y.

1. Membership and Attendance

A record of the attendance on each of the two meeting days is contained in Appendix A.

Appendix A also presents the status of membership (including alternate membership) as of the date of this meeting, including the changes reported in item 4., below.

A list was prepared during the meeting showing the name, company affiliation, address and telephone number of each X3.2 subcommittee member and alternate and of each proposed member and alternate for whom acceptance action is pending. Copies of this list were distributed at the meeting.

2. Agenda

An agenda for the meeting was offered by L. L. Griffin, Chairman-elect. Alan Ungar requested that an item 11 be added, titled: Proposal for Task Force on Message Format. With this change, the agenda appearing in Appendix B was adopted.

3. Minutes of Previous Meetings

Minutes are not available for the last three meetings of X3.2. It was recognized that this may be the result of the heavy work load carried by the secretary, R. E. Utman, who, incidentally, was absent from the meeting because of a business trip to Europe. It was agreed to discuss the situation with Mr. Utman after his return.

It was suggested, as a substitute arrangement, that the chairman dictate summaries of committee action at appropriate stages in future meetings and that such dictated records be typed and sent to members for changes and additions. The minutes of the meetings would then be prepared from the revised summaries. No action was taken on this suggestion.

4. Administrative Business

4.1 New Members and Resignations

The chairman-elect read a letter received from Leon Bloom announcing his resignation from X3.2 (since he is leaving NCR) and repeating his earlier proposal that A. H. Hassan be accepted as alternate member from NCR. It was moved, seconded and unanimously voted that A. H. Hassan be accepted as an alternate member. Future action will be required with respect to naming a regular member from NCR. Mr. Hassan was absent but he had sent a letter to Mr. Griffin stating that Sigmund Porter would attend the meeting in his place and requesting that Mr. Porter be given voting privileges. It was pointed out in discussion that it would be contrary to the committee's established procedure to assign the voting privilege to other than a duly elected alternate and, on this basis, a motion to give the voting privilege to Mr. Porter was voten on and was not passed. Mr. Porter was welcomed as an observer.

A letter was received from Mr. Wm. H. Burkhart of the Monroe Calculating Machine Company requesting that Harry Layton and Milton Mendelsohn be accepted as member and alternate, respectively (to replace M. Pivovonsky, who has resigned). Mr. Layton was present and reported on his qualifications for membership but, in accordance with established procedure, voting action on this recommendation was deferred to the next committee meeting.

Alan Ungar submitted an informal letter to the chairman-elect requesting that James Trawick be accepted as his alternate for I.T.T. Mr. Trawick, who was present at this meeting for the first time, reported on his qualifications but voting action was deferred until the next meeting.

The chairman-elect read a letter from Collins Radio expressing a vital interest in X3.2's activities and stating that they would like to participate and that they would send a representative to the current meeting. (No representative appeared at the meeting.) Mr. Griffin had already replied to the letter, stating the committee's practice with respect to new members, but he asked for member's comments. It was generally agreed that we should not exclude interested and qualified persons but that consideration should also be given to keeping the committee down to a reasonable size.

In connection with the foregoing, it was pointed out that there is an established procedure for dropping members who fail to attend two successive meetings without a

valid excuse and that the RCA member and alternate should be considered in this regard. They did not attend the current meeting nor the two preceding meetings in Washington and Chicago. It was agreed that the chairman-elect would write to RCA inquiring about the nonattendance and stating that membership would be discontinued as of the next meeting date unless RCA was represented or had otherwise intervened.

A letter received from C. E. Macon recommended that Paul Quantz be accepted as his replacement on X3.2 as the member for Burroughs Corp. (G. Shimabukuvo had previously been voted on and accepted as alternate.) This request had been made initially at the previous meeting (May 23-25 in Washington) and thus was ready for a vote at the current meeting. Also due for a vote was a request made at the May 23-25 meeting that R. M. Muise be accepted as a member representing Minneapolis-Honeywell. Both of these requests were put into the form of a motion, voted on, and passed unanimously. These additions to membership, as well as the resignations reported at this and the prior meeting, have been reflected in the membership list shown in Appendix A.

4.2 Task Force Membership Lists

Henry Tholstrup agreed to send to the chairman-elect the membership lists of the various tasks groups, X3.2.1 (punched cards), X3.2.2 (punched tape) and X3.2.3 (magnetic tape).

4.3 International Representative

A replacement was required for Leon Bloom in his capacity as international representative of X3.2 on the International Advisory Committee. It was moved and seconded that J. Auwaerter be appointed as international representative, and the motion was passed unanimously.

4.4 Liaison Representation with Other Committees and Subcommittees

Messrs. Auwaerter and Tholstrup explained the working and reporting relationships of the Joint Task Groups (JTG). There are three JTG's, as follows:

JTG - Punched Cards (TR27.6.1)
JTG - Punched Tape (TR27.6.2)
JTG - Magnetic Tape (TR27.6.3)

These report nominally to the Joint Steering Committee (X3-4-6) but minutes of their meetings, reporting the results of their efforts, are routed to EIA for subsequent forwarding to X6 and, through BEMA, to X3.2 and X4.A4. It is X3.2's understanding that each JTG is to state how X3.2's proposed code will be implemented in the media with which they are concerned.

L. L. Griffin, the liaison representative with X3.1 (optical character reading), had nothing to report.

J. B. Booth's report was submitted in writing (dated June 21, 1962), pointing out that X3.3 accepted the assignment of the SYNC character and the reservation of a position (0010000) for a Data Link Escape as a satisfactory compromise.

R. E. Utman, liaison representative with X3.4, was absent and no report was submitted.

The liaison representative with X3.5 (nomenclature) was Allen Whitman, who has resigned from X3.2. The matter of naming a replacement was tabled for the time being.

There is no representative for liaison with X3.6 (man to machine communication, flow charting, etc.) nor with X6. No representation is presently planned.

4.5 Schedule of Future Meetings

The following schedule of due dates and meeting dates was outlined:

July 9, 1962 - Joint meeting of X3.2 working group with X4.A4 to be held at BEMA Headquarters, starting at 10:00 a.m., to discuss the X4.A4 resolution of March 9, 1962.

July 13, 1962 - Position papers due on X3.2's proposed code.

July 25-27, 1962 - July meeting of X3.2 in the Los Angeles area to prepare written replies to position papers (see Item 8., below). Paul Quantz will arrange a conference room in the vicinity of the Los Angeles airport and will make hotel reservations for those who request them.

August 3, 1962 - Rebuttal papers due.

August 21, 1962 - Meeting of X3 and vote on proposed code.

August 22 & 23, 1962 - Meeting of X3.2 at BEMA Headquarters in New York City (may extend to Friday, August 24).

4.6 Distribution of Papers

The following papers, letters and notes were distributed:

Minutes of joint meeting of X4-A2 and X4-A3 subcommittees on April 10 and 11, 1962 which was attended informally by Leon Bloom.

X3.3-X3.2 Liaison Report No. 4, dated June 21, 1962.

Minority position paper of June 5, 1962 by R. E. Blue in opposition to the X3.2/7 resolution to substitute the 5-25-62 code for the originally proposed ASCII of 11-10-61. Paul Quantz will prepare the rebuttal with the aid of other X3.2 members located on the west coast.

Minority position paper of June 11, 1962 by Alan Ungar in opposition to the X3.2/7 resolution. L. L. Griffin and J. B. Booth were assigned the responsibility for preparing the rebuttal.

Minority position report of June 8, 1962 received from R. E. Blue stating the reasons of R. E. Blue and Alan Ungar for voting against the X3.2 motion of May 23, 1962.

Other position papers as discussed under Item 8.

5. Report on Task Groups and Working Groups

5.1 X3.2.1 Joint Subcommittee on Punched Cards

J. B. Booth, who was absent on the first day of the present meeting, had submitted a conference memorandum dated June 18, 1962 stating that the Subcommittee concluded there were three alternatives available for standardization of the code representation in punched cards:

1. Extend the existing punch card code to include the character set of the proposed ASCII.
2. Modify the existing punch card code to simplify translation to the proposed ASCII, maintaining the card handling characteristic of the existing punch card equipment.
3. Develop a new code representation for punch cards consistent with the proposed ASCII.

The Subcommittee elected to proceed first with analysis of alternative number 1, and two arrangements were developed as a basis for further study.

5.2 X3.2.2 Joint Subcommittee on Punched Tape

J. Auwaerter reported that the scope of the Subcommittee's work had been determined, including:

Set a physical standard for one inch paper tapes, physical specifications, how code will be entered, etc.
Work on paper tape reels and splicing.
Work on the grid (dimensions and tolerances).
Work on chemical composition of paper.
Consideration of error control, limited to date to vertical parity check.

5.3 X3.2.3 Joint Subcommittee on Magnetic Tape

In the absence of Ted Bonn, Dick Muise reported on a Subcommittee meeting held on June 13, 1962 at which consideration was given to formulating a standard for magnetic tape which would include the IBM BCD code representation. It was argued that the standard should be limited, at this time, to the physical characteristics of the tape. In a final vote, it was decided to omit any reference to a code in the magnetic tape standard.

J. Auwaerter then suggested, in the present X3.2 meeting, that the JTG be requested to specify how the ASCII of May 25, 1962 would be represented on magnetic tape.

Since Ted Bonn will probably be absent for an additional period of time, it was moved and seconded that Dick Muise be appointed the liaison representative of X3.2 on the JTG for magnetic tape. The motion was passed unanimously.

5.4 X3.2 and X4.A4

Next meeting scheduled for July 9, 1962 (item 4.5, above).

6. Report on X3 Meeting on June 22, 1962

L. L. Griffin reported that the X3 Committee accepted the revised code proposed by X3.2 but moved up the date for final voting on the revised code from September 1, as suggested by X3.2, to August 21, 1962. Minutes of the X3 Committee were not available.

7. IBM Submission of June 22, 1962

R. E. Blue's letter of June 22 proposed an extension of X3.2's activity to include preparation of a parallel standard code for punched cards. There was considerable discussion of the proposal, including possible ways in which some standardization of a punched card code might be included as an appendix to the ASCII single standard as an aid to the ultimate conversion to the single ASCII. Comparable recommendations, in appendix form, could also be prepared for the Baudot, 5-level code and for the Fieldata (Mil 188A) code. The discussion was concluded and J. E. Bartelt offered the following motion:

> Move that the X3.2 Subcommittee undertake the action recommended in R. E. Blue's letter of June 21, 1962 to C. E. Macon, Chairman, and L. L. Griffin, Chairman-elect.

The motion was seconded by Alan Ungar and in the ensuing vote there were 2 votes in favor and 4 against, thus defeating the motion.

8. Discussion of Position Papers and Preparation of Replies

At this point it should be recorded that written ballots have been received by mail from M. Pivovonsky (for Monroe Calculating Machine Company before the date of his resignation from X3.2) and from H. Spielman (alternate member for RCA) on the X3.2 Subcommittee Resolution X3.2/7 of May 25, 1962. Both votes were in favor of the resolution.

Assignments for the preparation of replies and rebuttals to position papers were made to individual member groups based on geographical and subject matter considerations as indicated by the following notes:

Minority position paper of June 5, 1962 by R. E. Blue in opposition to the X3.2/7 resolution to substitute the 5-25-62 code for the originally proposed ASCII of 11-10-61. Paul Quantz will prepare the rebuttal with the aid of other X3.2 members located on the west coast.

Minority position paper of June 11, 1962 by Alan Ungar in opposition to the X3.2/7 resolution. L. L. Griffin and J. B. Booth were assigned the responsibility for preparing the rebuttal.

Minority position report of June 8, 1962 received from R. E. Blue stating the reasons of R. E. Blue and Alan Ungar for voting against the X3.2 motion of May 23, 1962 recommending support of "Proposal B" of Working Group B resolution of May 3-4, 1962 as modified. Messrs. Griffin and Booth will prepare the rebuttal, with help from Paul Quantz, if requested.

Majority report of the X3.2 members in favor of the X3.2 resolution recommending support of "Proposal B" of Working Group B as modified. A draft of this report was prepared and presented by J. B. Booth and minor changes were agreed upon in the present meeting. Adoption of this reported as revised was voted upon favorably by the seven members present who represented the majority position.

Letter from R. W. Ferguson, AIEE Representative to X3, raising questions about the proposed ASCII. Paul Quantz has prepared a draft of a reply on which he had not yet been able to obtain comments from C. E. Macon. In view of the fact that a reply to this letter is required in time for the next AIEE meeting on the subject on July 6, 1962, the committee as a whole listened to preliminary draft version and made general comments on the 6 major sections. Messrs. Booth, Gryb and Quantz will accept these comments as "expressions of intent" and will incorporate them into the draft so that a final reply may be made within about one week.

Position paper from Monroe Calculating Machine Company dated June 13, 1962. J. F. Auwaerter will prepare the rebuttal with support from Messrs. Muise and Bousquet.

Position paper from IBM dated June 6, 1962 and signed by W. E. Andrus, Jr. Since the representations in this paper are much the same as those contained in the minority position paper from R. E. Blue dated June 5, 1962, Paul Quantz will prepare the rebuttal.

A memorandum from ITT Communications Systems, Inc., dated June 18, 1962 was received by X3.2 but the chairman-elect ruled that no reply from X3.2 is called for at this time, since the memorandum does not constitute a formal presentation.

The chairman-elect pointed out that additional position papers will be coming in from time to time. BEMA will send copies to all X3.2 members and L. L. Griffin will make additional assignments for rebuttal papers in each case. It was agreed that an individual reply should be made in each case. (No replies will be required for position papers which are favorable to the proposed code.) To the extent possible drafts of rebuttal papers, prepared

by individual or groups of X3.2 members, should be sent to all members prior to the July 25 meeting. Final drafting of rebuttals will be completed at the time of the July meeting in Los Angeles and final versions will be authorized by X3.2 as a whole.

9. Papers for Publication

C. E. Macon submitted a paper entitled "The Proposed American Standard Code for Information Interchange" and requested approval of X3.2 for him to publish it as a nontechnical history of the ASCII formulation. (This is the paper which was read by J. F. Auwaerter during the two presentations to government personnel on May 24 & 25.) The following motion was made and seconded:

> The X3.2 Subcommittee approves the request of Mr. Macon for publishing an article based on the paper prepared for presentation to the Government on May 24 and 25 covering the history of the work on ASCII.

The motion was passed by unanimous vote. Mr. Macon's paper was duplicated at the current meeting and distributed to the members present.

On the theory that the work of the X3.2 Subcommittee will not be fairly or completely represented by the negative approach of responding to unfavorable position papers, it was agreed that all members should prepare monographs in support or explanation of various phases of the code with which they are most familiar. Suggested subjects included:

Punched card conversion

Punched card code related to ASCII

Magnetic tape representation

Processing advantages of ASCII

The case for a single standard code

A series of papers on ASCII implementation

International considerations

Proposed code vs Fieldata 188A -- advantages in a technical sense

Why zero should be slotted below 1 instead of above 9

Why the alphabet should be contiguous and in normal sequence

Why a 7-bit set was adopted

ASCII implementation in typewriter keyboards
Expansion and contraction to larger and smaller sets
Collating sequence

Members were urged to prepare papers on these and similar subjects as a means of supporting the ASCII.

10. Economics of the Proposed X3.2 Code

This subject was discussed to determine whether specific support could be made for the proposed code from a cost saving standpoint. While it was agreed by those in favor of ASCII that economic advantages of a large order would result from use of the proposed code, it was also recognized that these advantages are general and widespread in nature so that it would not be possible to cite specific dollar savings in a particular case. No further action is planned in this area.

11. Proposal for Task Group on Message Format

Alan Ungar stated there is a need for work on message format. In particular he stressed the need for message format for civilian use and said that work in this area would shed light on additional control codes required. Several of the other members were unable to grasp what would be gained by format standardization, and the question was raised as to whether such a subject is an area for X3.2 activity since individual users would presumably determine message format, within the framework of the proposed code, in the light of their own and related system requirements.

John Booth stated that he understands that the X3.3 committee on data transmission is addressing itself to the problem of message format. It was agreed that Alan Ungar should determine from his associate on X3.3 whether X3.3 has the assignment for message format determination and that further action by X3.2 would be deferred until this question has been answered.

It was moved, seconded and unanimously voted to adjourn at 3:55 p.m. on June 28.

Respectfully submitted,

DEC for (7/10/62)
J. F. CHESTERMAN
Acting Secretary, for
R. E. UTMAN

HO-3112-JFC-DDT

Att.
Appendices A and B

APPENDIX A

X3.2 Meeting

June 27 & 28, 1962

MEMBERSHIP STATUS AND ATTENDANCE

Member	Affiliation	June 27	June 28	Alternate	June 27	June 28
Persons with membership status at the current meeting						
J. F. Auwaerter	Teletype Corp.	X	X	J. B. Booth		X
R. E. Blue	IBM	X		J. E. Bartelt	X	X
T. H. Bonn	Remington Rand			R. E. Utman		
J. F. Chesterman	Bell Tel. Labs	X	X			
L. L. Griffin	Navy Dept.	X	X			
R. M. Gryb	AT&TCo.		X			
	NCR			A. H. Hassan		
H. Kleinberg	RCA			H. Spielman		
	Monroe Calc. Mach. Co.					
R. M. Muise	Minneapolis-Honeywell	X	X	T. R. Bousquet	X	X
Paul Quantz	Burroughs Corp.	X	X	G. Shinabukuro		
H. Tholstrup	Friden, Inc.	X	X			
Alan Ungar	I. T. T.	X	X			
Persons proposed for membership						
Harry Layton	Monroe Calc. Mach. Co.	X	X	M. Mendelsohn		
	I. T. T.			James Trawick	X	X

In addition the meeting was attended by the following persons, for the reasons indicated:

Sigmund Porter was present on June 27 and 28 as an observer for the National Cash Register Co. in the absence of A. H. Hassan

Dick Scott was present on June 27 as an observer from I. T. T.

The list of members shown above incorporates the following recent changes:

Business Affiliation	Change in Member Representation
Bell Tel. Labs.	J. F. Chesterman replaced A. L. Whitman, who has retired from the Laboratories.
NCR	Leon Bloom resigned upon leaving NCR A. H. Hassan elected as alternate.

APPENDIX A
cont'd - 2

Business Affiliation	Change in Member Representation
Monroe Calc. Mach. Co.	M. Pivovonsky resigned upon leaving Monroe.
Minneapolis-Honeywell	R. M. Muise elected as member to replace R. W. Reach.
Burroughs Corp.	Paul Quantz elected as member to replace C. E. Macon, who has resigned, and G. Shimabukuro elected as alternate.

APPENDIX B

ASA X3.2 - Character Sets and Data Formats

AGENDA - Meeting of June 27 - 28, 1962, BEMA Headquarters,
235 E 42nd St., New York 17, New York

1. Attendance
2. Agenda - additions
3. Minutes of previous meetings
4. Administrative Business
   - 4.1 New Members and resignations
   - 4.2 Task Force Membership Lists
   - 4.3 International representative
   - 4.4 Liaison representatives with other committees and subcommittees
   - 4.5 Schedule of future meetings
   - 4.6 Distribution of papers
5. Report on Task Groups and Working Groups
   - 5.1 X3.2.1
   - 5.2 X3.2.2
   - 5.3 X3.2.3
   - 5.4 X3.2 - X4.A4
6. Report on X3 meeting 22 June 1962
7. IBM submission of 21 June 1962
8. Discussion of position papers and preparation of page 8 replies
9. Papers for publication
10. Economics of the proposed X3.2 code
11. Proposal for Task Force on Message Format

ASA X3.2 Membership List
June 28, 1962

Member	Alternate
John F. Auwaerter Director of Product Development Teletype Corporation 5555 Touhy Avenue Skokie, Illinois Tel: 312 OR 6-1000	John B. Booth Teletype Corporation 233 Broadway Room 624 New York, New York Tel: 212 WO 2-1876
Robert E. Blue IBM Corporation 112 East Post Road White Plains, New York Tel: 914 WH 9-1900 (Ext 5962)	M. J. Franklin (Proposed) IBM Corporation Data Systems Division South Road Laboratory Poughkeepsie, New York Tel: 914 GL 4-1000 (Ext 5886 M)
T. H. Bonn Remington Rand Univac P.O. Box 500 Blue Bell, Pennsylvania Tel: 215 MI 6-9000	E. H. Clamons (Proposed) Remington Rand Univac P.O. Box 500 Blue Bell, Pennsylvania Tel: 215 MI 6-9000
J. F. Chesterman Bell Telephone Labs (2F 517) Holmdel, New Jersey Tel: 201 949-3968	None
L. L. Griffin Navy Management Office Navy Department Washington 25, D.C. Tel: 202 OX 6-7277	None
R. M. Gryb American Tel. & Tel. Co. 195 Broadway New York, New York Tel: 212 393-9800	None
Abe Hassan National Cash Register Co. Electronics Division 1401 E. El Segundo Blvd. Hawthorne, California Tel: 213 PL 7-1811	Sig Porter National Cash Register Co. Electronics Division 1401 E. El Segundo Blvd. Hawthorne, California Tel: 213 PL 7-1811
Harry Layton Monroe Calculating Machine Co. 555 Mitchell Street Orange, New Jersey Tel: 201 OR 3-6600	M. Mendelsohn Monroe Calculating Machine Co. 555 Mitchell Street Orange, New Jersey Tel: 201 OR 3-6600
Richard M. Muise Minneapolis-Honeywell EDP 151 Needham Street Newton Highlands 61, Mass. Tel: 617 DE 2-6960 (Ext 374)	T. R. Bousquet Minneapolis-Honeywell EDP 151 Needham Street Newton Highlands 61, Mass. Tel: 617 DE 2-6960 (Ext 374)
Paul Quantz Burroughs Corporation 460 Sierra Madre Villa Pasadena, California Tel: 213 SY 3-6121	George Shimabukuro Burroughs Corporation 460 Sierra Madre Villa Pasadena, California Tel: 213 SY 3-6121
H. Tholstrup Commercial Controls Corporation Friden, Inc. One Leighton Avenue Rochester 2, New York Tel: 716 BU 8-1600	None
Alan Ungar International Tel. & Tel. Co. Box 285 Paramus New Jersey Tel: 201 CO 2-6800 (Ext 341)	James Trawick International Tel. & Tel. Co. Box 285 Paramus, New Jersey Tel: 201 CO 2-6800 (Ext 341)
H. Kleinberg Manager Computing Devices Eng. Radio Corporation of America Electronic Data Processing Division Camden 2, New Jersey Tel: 609 WO 3-8000	H. Spielman Computing Devices Eng. Radio Corporation of America Electronic Data Processing Division Bldg. 82-1 Pennsauken, New Jersey Tel: 609 WO 8-3000 (Ext PK3249)

Consultants

H. J. Smith
IBM Corporation
Poughkeepsie, New York

C. E. Mackenzie (Proposed)
IBM Corporation
Data Systems Division
South Road Laboratory
Poughkeepsie, New York
Tel: 914 GL 4-1000

3EMA

Paper 107-62/SC100-15
June 28, 1962

RADIO TECHNICAL COMMISSION FOR AERONAUTICS
Room 1072, Building T-5
16th & Constitution Avenue, N. W.
Washington 25, D. C.

MINUTES OF THIRD MEETING

June 26-27-28, 1962

Special Committee 100

Data Link System Requirements

The meeting was called to order at 0930, 26 June 1962, in Room 5C-1042, Pentagon, by the Chairman. A list of those attending is attached as Paper 108-62/SC100-16.

Mr. Bartlett (RCA) requested that the Minutes of the Second Meeting - Paper 60-62/SC100-3 - be amended by deleting the last two sentences of the final paragraph on page 3 and inserting the following: "Mr. Bartlett said the experimental AGACS equipment built by RCA had fulfilled the program objective. Tests established feasibility. The equipment is currently in use at NAFEC in operational simulation. Action was suspended by the FAA on the tentative specifications for engineering models (Paper 86-61/EC-425) when the Project Beacon Committee was established." The minutes were approved with this amendment.

Mr. John Auwaerter of the Teletype Corporation, assisted by Mr. Paul Quantz of the Electrodata Division, Burroughs Corporation, and Mr. L. L. Griffin, Navy Department, explained the background and status of the American Standards Association's X3.2 committee's data code and character set proposals as the first order of business.

Mr. Auwaerter stated, by way of introduction, that the actual growth in data communications is now 25% per year. Another way of looking at the importance of the problem, since the rate of growth is also accelerating, is to understand that in 5 years, data communications will be four times what they are today. In ten years, AT&T expects that more communications will be via data than by voice. Voice and data systems will grow together: the voice/data interface will be hard to find.

Europe is engaged in intensive standardization in all fields. This action began before the common market was formed, but has accelerated as a result of European economic unity. In all fields,

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data communications included, their standards will affect us.

Mr. Quantz then explained the organization of the American Standards Association. It was formed in 1920 from the old American Engineering Standards Committee. It is a federation of 126 national organizations comprising about 2200 companies. A set of procedures has evolved containing checks and balances to obtain a true consensus of the industrial population. To avoid a purely national approach, ASA has joined the International Standards Organization (ISO) located at Geneva. This consists of a union of the non-governmental standards associations of 44 nations. The objective of ISO is to coordinate national standards for voluntary use of preferred standards internationally.

In the case of data, ASA followed the usual practice of assigning the problem to a member trade association which had direct interest. The Business Equipment Manufacturers Association (BEMA) was chosen as sponsor of the X3 effort on data processing system standards. The X3 sectional committee split into a number of sub-groups aimed at specific sub-tasks. Sub-committee X3.2 investigated code and character sets. Sub-committee X3.3, just commencing actual deliberations, is considering data transmission standards. Mr. Quantz concluded by emphasizing the need for a single standard in data systems coding.

Mr. Auwaerter then explained the relation between the committees of the ISO in Geneva and ASA's X3.2 effort. In general, ISO has a Technical Committee (TC-97) which is the international body paralleling the ASA X3 sectional committee on data systems standards. Under TC-97 is Working Group B, with an international charter similar to the national charter of ASA X3.2. In effect, X3.2 reports to TC-97 W.G.-B.

The X3.2 subcommittee began work in Fall 1960. IBM chaired the group initially. The work initially consisted of investigating the system criteria of two previous sources: the Electronics Industry Association, and the Fieldata criteria developed by Dr. Leubbert, (Major, USA). X3.2 met for three days a month for eight months. Initially, they sought a 6-bit set of 64 characters, but after looking at Fieldata, it became apparent that a 7-bit set could potentially satisfy the needs of all users, with only minor compromises. X3.2 met with Mr. Haraitz (U.S. Army Signal Research and Development Laboratory, Ft. Monmouth, N. J.) to see how Fieldata (FD) could be adapted to fit all present data systems criteria.

X3.2 sought to preserve the natural binary order of FD code, and the logic of the position of alpha-numeric characters. They tried to make minimum code changes in modifying and adapting FD to European needs and to typewriter type input devices, as well as optimize it for machine collation purposes. However, even minor code changes were found to result in major hardware changes.

As recently as ten months ago, X3.2 had the alphabet in the same location as FD code. It was the needs of Europe which changed that. Regardless, all the Fieldata criteria, as postulated by Dr. Leubbert in his doctoral dissertation at Stanford, are still met.

Mr. Howard Smith of IBM devised a 64-bit graphic subset for X3.2. Numbers and symbols were settled in logical collation order. Characters were assigned binary values in the same order as the preferred collating order. The code was organized by classes of characters to distinguish easily when an alpha symbol or digital character was encountered. It was also easy to distinguish between controls and graphics. The resulting product was not the best code for any specific purpose -- such as machine use, input-output devices, terminals or transmission systems -- but it was usable by all. Finally, X3.2 agreed on a certain number of control functions. Larger, more complex functions would combine characters using the "escape" concept. These actions were completed last Fall (1961).

Then X3.2 made a decision on the question: Should they keep this standard in their pocket without any formal backing from the U. S. as a whole, or publicize it? X3.2 published their code, and determined to get advance international reaction to it.

The first European contacts were by Mr. Auwaerter and Mr. Leon Bloom of National Cash Register. They had the mission of obtaining European reaction and to make any adjustments which might appear suitable in time to affect the Plenary Session of ISO TC-97 scheduled at Paris, France, in October 1962.

There were two meetings. The first was in March in Rome, with the European Computer Manufacturers Association (ECMA), and the second in May in Paris with TC-97 Working Group B. A 7-bit character set was agreed upon for general information exchange; a related 6-bit subset for use inside computers in Europe (but not on line) was also agreed upon. This is known as "Proposal B", and represents the Paris compromise - which is the code presently recommended by ASA X3.2.

Mr. Griffin, of the Navy Management Office, explained the specific difficulties with collation (FD vs. ASA X3.2). The European computer manufacturers were concerned primarily with computer rules and they had not considered /or had de-emphasized/ communications. Their considerations did not envisage unattended operation, especially the acknowledged problem, in telex operation.

While TC-97 was considering data systems problems, there was a growing jurisdictional problem within the ISO. The TC-95 working on office machine standards, and the TC-54 on electrical standards were conflicting with TC-97 in claiming control of certain standards applications. All claimed control of the media affecting their specialized purposes. Joint working groups are now attempting to get agreement on interchange problems.

"Two years ago", said Mr. Auwaerter, "Bell recognized that the world was changing." Bell made a decision to provide a full complement of data communications services. They determined to convert the manually switched TWX service to a system compatible with the line-switched DDD system.

On Labor Day /3 September 1962/ 65,000 stations will be cut over to the DDD system. A few months ago /In December 1961/, the Bell System made an "irreversible decision" to convert all TWX service to an interchange message-switched system, based upon the X3.2 /Proposal B/ code. All private wires will also be eventually converted . . . many of them, relatively soon. The Bell "experiments" with Delta and United Airlines had irrefutably shown the commercial worth of automatic message switched services, and the continued popularity and real practicality of typewriter-like keyboard devices used with these systems.

Bell (according to Mr. Auwaerter) felt certain that Canadian Bell would follow their lead in the adoption of X3.2 standards. Bell also shared the common opinion that, despite its very positive good points, the Fieldata code could not live internationally. They were also equally certain that the ASA X3.2 code /Paris compromise, Proposal B/ had every chance of universal international application, especially if vigorously applied now.

Out of the many possible alternatives, X3.2 (Paris compromise) appears most acceptable to all. Certainly, Europe can't abandon 5-level Baudot overnight (6 pulse shift operation might also have been used). In any case, Europe won't (because of economic compulsions)move 5-level Telex to 7-level ASA now; but they know what Bell is doing, and will probably do the same in the future.

NOTE: Mr. Auwaerter made available to SC100 the following material, copies of which are attached to these minutes:

1. Report on the Meeting of ISO TC/97 WGB on Character Codes and Sets (Paris, May 2-4, 1962).

2. Letter dated June 6, 1962 from the Chairman X3.2 to the S3 Sectional Committee, with attachments X3.2/4; X3.2/5; X3.2/6 and X3.2/7.

Mr. Alan Ungar of International Electronics Corporation (IEC), an AT&T subsidiary, then delivered a strong minority position attacking X3.2 code recommendations. He was supported by Mr. Robert Blue, of IBM. A copy of this Minority Position is attached to these minutes as Paper 109-62/SC100-17.

Mr. Ungar explained that the United States has already invested 2.5 Billion Dollars in systems not in conformity with X3.2 code recommendations. He cited as prime examples the Naval Tactical Data System (NTDS), the Air Force Ballistic Missile Early Warning System (BMEWS - System 474L) and the Semi-automatic ground environment (SAGE, defense system 416L), as well as various Army command, control and communications systems.

Mr. Ungar criticized the X3.2 as not going far enough beyond today's systems. There were not enough controls, for example. Another factor, it would cost more (according to his analysis) to interface to X3.2 with present systems, than to interface to FD code. We had to really examine where we actually were, in terms of economics and technical capabilities. We had also to examine what was the best way -- whether to evolve, or make a sudden jump (as X3.2 would occasion) -- in arriving at over-all improved data systems capabilities.

Mr. Bob Blue, of IBM, then supported Mr. Ungar's position, with a separately conceived IBM position. In general, said Mr. Blue, IBM didn't want a "shotgun wedding" between communications and data processing, with ASA X3.2 holding the shotgun.

Mr. Blue pointed out that the initial use of data processing codes, was primarily centered around the punch card. Its needs and media limited the code in a practical manner. Price limited the technical potential.

There essentially is a standard in EDP (Electronic Data Processing) in the 64-character set now in general use in data processing equipment I/O (input - output) devices -- such as magnetic tape, punch cards and paper tape. However, IBM is aware of the eventual need for change. Perhaps we need to take a really long look before we disturb what is working well for us today. Maybe we need to overleap a 7-bit set and move to an 8-bit set as the next tier, or plateau, of achievement. 7 bits appears neither fish nor fowl; it will not efficiently use memory; right now with a large amount of numeric data, a 4-bit set appears to be adequate. A 6-bit set appears enough for alpha-numerics. Users are not anxious to see a variety of input-output devices. The jump from 6-bit to 7-bit devices might just as well gain us the capability of 8-bit codes. "We seem" said Mr. Blue, "to be reacting to international pressure and communications needs to implement now, or next year. Europeans do not have punch card orientation. They use typewriter or tape punch devices to obtain the lowest cost data processing. Their objective is more low cost than efficiency. A 7-bit code set won't serve the "lowest cost" objective; so, they use a 6-bit set.

"We are kidding ourselves," said Mr. Blue, "on agreement. If Europe goes to a 6-bit set, and we go to a 7-bit, then that is not a true uniform international standard." Rather, we have adopted as an international interchange (communications) code, one which accepts European variances, and rejects United States precedence, and current practice. Accordingly, by no means can X3.2 be considered an international standard.

"It appears", said Mr. Blue, "that we will not eliminate translators for an unforeseeably long time. That is an unhappy fact." Every media of carrying or handling data has its own best way (or code). Delete is used to erase paper tape; magnetic tape can't have all zeros; a machine can't see all zeros go by. What we really need to do is develop optional codes based on media. This includes the transmission media, with which X3.2 seems to have been engrossed.

Perhaps, Mr. Blue suggested, we are jumping the gun. Perhaps, before coordinating the X3.2 code informally on an international basis, we should have fully considered the U. S. reaction. Have we imposed costs on some segment of the data systems field that are truly unbearable? IBM and Monroe have previously commented on this.

Have we made significant enough operational gains to warrant the costs? Have we considered the (approximately) 50% more magnetic power required in going from Hollerith to X3.2 codes? Significant economic advantages do not seem to be offered. There are also conversion costs to punch tape code. The X3.2 committee does not seem to have made an economic analysis. For example, the X-4 sectional committee of ASA (a brother committee of X-3, the parent of X3.2), which is interested primarily in office machine manufacturers' problems, has already attacked the X3.2 code, principally on the lack of a thoroughgoing economic analysis.

In order for a new code to stand up against what we have now, it MUST:

1. Have enough economic return to warrant adoption.
2. Offer a smooth transition from existing practices.

Appendix III

July 10, 1962

JOINT MEETING OF X4A4 & X3.2 WORKING GROUP ON X4A4 RESOLUTION

DATE: July 9, 1962

PLACE: BEMA Headquarters, NY, NY

ATTENDANCE:

X4A4

Messrs. J. B. Macfarlane - IBM, Chariman
E. C. Aghib - Monroe
C. J. Davis - IBM
J. Engstrom - Remington Rand
R. Haney - Smith Corona
R. Malone - Friden
J. T. Murphy - Royal McBee
R. Nixon - NCR
W. J. Osterman - Friden
R. Gallant - Underwood

X3.2

Messrs. R. E. Blue - IBM
J. B. Booth - Teletype Corp., Steering Member
A. H. Hassan - NCR
H. Tholstrup - Friden

BEMA OMG

C. E. Ginder

BEMA DPG

G. M. Wilson

ASA

V. Grey

The discussion divided into three areas: (1) background, (2) clarification of OMG resolution of June 15, 1962, and (3) position of the members of X4A4.

1. Background

a. In February 1962 X4 referred the Proposed American Standard Code for Information Interchange (ASCII) to X4A4.

b. On March 9, 1962, X4A4 passed a resolution relating to the proposed ASCII.

c. Leon Bloom represented X3.2 at a X4A2 meeting in Chicago, Illinois in April, 1962.

d. Informal discussions were held between members of X4A4 and X3.2 in Chicago, Illinois in April, 1962.

NMAH 310/3

e. On May 11, 1962 X4 accepted the X4A4 resolution of March 9, 1962.

f. On May 24, 1962 the X3.2 Subcommittee appointed a Working Group to work with X4A4 for the purpose of clarifying the statements contained in the X4A4 resolution of March 9, 1962.

g. On June 15, 1962 the Office Machines Group (OMG) Engineering Committee of BEMA passed a resolution (see Appendix A).

2. Clarification of OMG Resolution

Mr. Wilson questioned the reference to the "Joint I-O Steering Committee." It was agreed that this should have been "Joint X3, X4, X6 Steering Committee." Although this Steering Committee was set up originally to eliminate the overlap in the development of standards for media, it was stated that this Joint X3, X4, X6 Steering Committee would have jurisdiction in the development of coded character sets.

Mr. Booth questioned the intent of the phrase "develop an alternate or joint preferred code." Messrs. Ginder and Macfarlane agreed that the intent of the resolution was not that of recommending that X4A4 develop a new code, but only point out specifically, in technical terms, their objections to the proposed ASCII; this may include, of course, a recommended restructing of the proposed ASCII.

Mr. Ginder stated that the Joint X3, X4, X6 Steering Committee may elect to set up a joint committee (of X3, X4 and X6) for the development of a code for information interchange.

3. X4A4 Positions

a. Monroe

Mr. Aghib read Monroe position paper dated June 13, 1962 (See Appendix B)

The main argument is that the present structure of the proposed ASCII will require that numeric (4-bit) tape punches add two holes (total of six maximum) to each numeric.

b. Friden

Mr. Osterman stated that

(1) Friden is in favor of a standard interchange code but that it must be accepted.

(2) Terminal equipment cost would increase by approximately 30% if the proposed ASCII is used.

NOTE: No details were given to support this figure.

(3) They would favor a dual standard, e.g., a Hollerith based and an X3.2 type.

c. Victor

Mr. Ginder stated that Victor supported a dual standard.

d. Royal McBee

Mr. Murphy reported that Royal McBee had not taken a position.

e. Smith Corona

Mr. Haney stated that Smith Corona is interested at arriving at a standard.

f. Remington Rand

Mr. Engstrom stated that Remington Rand favored a dual standard.

g. NCR

Mr. Nixon had no comment.

h. IBM

Mr. Davis referred to Mr. Andrus' letter of June 6, 1962 to the BEMA DPG Engineering Committee.

The author suggested that X4A4 prepare documents to show why the present structure of the proposed ASCII will result in economic penalties in new equipment designed to implement the proposed ASCII.

Mr. Macfarlane agreed to procede with the drafting of the technical arguments. He requested all X4A4 members to submit their arguments to the OMG Engineering Committee by July 30, 1962; it was suggested that duplicate copies be submitted so that the OMG Engineering Committee can transmit a copy, if they so elect, to DPG Engineering, who in turn would forward to X3.2

Messrs. Aghib, Engstrom and Malone were appointed to conduct liaison activities with X3.2.

J. B. BOOTH

JBB:JS

Appendix A
(to Appendix III)

After being discussed, moved and seconded, it was unanimously voted by the Office Machines Group Engineering Committee at their June 15, 1962 meeting, to recommend the following resolution to the X4 Sectional Committee:

Resolution

The Office Machines Group Engineering Committee recommends that the X4 Sectional Committee instruct the X4-A4 Subcommittee on Input-Output Equipment to develop an alternate or joint preferred Code; which should then be be submitted to the OMG Engineering Committee to confirm the industry's position. The OMG Engineering Committee will then submit the approved Code to the X4 Sectional Committee for transmission to the Joint I-O Steering Committee.

June 26, 1962

RESOLUTION X4-A4 SUBCOMMITTEE (Input-Output)

TO THE X4 SECTIONAL COMMITTEE

Foreword

After being discussed, moved and seconded, it was unanimously voted by the X4-A4 Subcommittee (Input-Output) at their March 9, 1962, meeting to recommend this Resolution to the X4 Sectional Committee.

Resolution

We appreciate the work and effort of X3.2 Subcommittee (Coded Character Sets and Data Formats), of the X3 Sectional Committee (Data Processing), in developing the proposed X3.2 Code for Information Interchange. We recognize the difficulties that they have already overcome in achieving a code which has satisified so many segments of the industries involved. However, we do not feel that the Office Machine Manufacturers can economically implement this code in their equipment and that it will also impose severe limitations on their development.

It is, therefore, recommended to X4 that they urge the X3 Sectional Committee to direct X3.2 to consider rearrangement of the proposed graphic subset so as to make it more closely compatible with the Hollerith Code, which permits the most commonly typewritten characters to be arranged in 4 X 12 and 3 X 16 graphic arrays. The desired code should be as suitable for collation as the present Hollerith Code and should require a minimum number of marking levels for recording of numeric data.

Possibly, the solution is to standardize more than one sixty-four (64) character graphic sub-set.

ON THE COLLATING SEQUENCE OF "+" AND "-"

S. N. Porter July 11, 1962

The purpose of this paper is to show that whatever the collating sequence of "+" and "-", a binary sort, suitable for alphabetic sorting, will not sort the numerics into algebraic order, if any of the conventional ways of representing numerics are used; and further, if the numerics are represented in such a way that they are put into algebraic order by a binary sort, the collating sequence of "+" and "-" is irrelevant.

Although it does not matter to most of the argument, for simplicity we will assume bcd coding of the numerics. The choices that remain are (1) fixed or variable field length, (2) sign on right or left end of field, (3) positive numbers labled "+" or left unsigned, and (4) absolute value and sign or complementary representation. For the purposes of this paper, the problems in the choice of fixed or floating point are subsumed by the list above.

1. Field Length. If all fields to be compared with each other are the same length, then field length is not a consideration. It is now almost universal however, in business data processing, for field length to be variable. For alphabetics we sort with the fields aligned on the left. For most business applications we sort numerics with the fields aligned on the right. Therefore, even without worrying about signs, the same sort process is not, in general, applicable to both alphabetic and numeric data.

2. Sign Position. There are now many computers in which the sign is on the right end of numeric fields. There are strong reasons to expect that machines will continue to be made the sign on the right end. In a numeric sort the sign should be regarded as the most significant character. If the sign is on the right end of the field a binary sort will treat it as the least significant character, and consequently, positive and negative numbers will be interspersed instead of separated. This will be true whatever the choice of codes for "+" and "-".

3. Unsigned Numbers. There are machines which do not attach a sign character to positive numbers and use "-" for negative numbers. This representation is not ambiguous, and allows more efficient use of memory; we may expect to see this representation in many future computers. Since "+" is not used as a sign, the collating sequence of "+" and "-" is immaterial.

NWA H 310/3

4. Complementary Representation. Most computers use absolute value and sign rather than complements for negative numbers. For decimal machines and business oriented data processors this usage is even more common. Assuming the problems in the above paragraphs have been solved, a binary sort of numbers represented using absolute value and sign will result in the negative numbers being sorted in order of increasing negativeness, and the positive numbers in order of increasing positiveness, rather than sorting all numbers in algebraic order (increasing positiveness). Once again the same sort process cannot be used for alphabetics and numerics, whatever the codes for "+" and "-". If we adopt the now unconventional technique of representing negative numbers in complementary form then a binary sort will sort numerics into algebraic order. In order to distinguish numbers in complementary form from numbers in conventional form (absolute value and sign) one should use a different sign character. In particular "*" would be an excellent choice for the sign of a complemented number. Using "*" for complemented numbers and either "+" or no sign for positive numbers (and assuming the May 25 X3.2 code) will permit a binary sort to sort numerics into algebraic order. In this case since "-" does not enter into the sorting process the collating sequence of "+" and "-" is immaterial. (Note: "-" for complements and no sign for positive numbers will also work.) It should be recognized that it is unlikely that business oriented data processor will adopt complementary notation.

We conclude that the collating sequence of "+" and "-" is not significant.

Data Processing Group

bema

Business Equipment Manufacturers Association
235 East 42nd Street, New York 17, New York — MUrray Hill 7-5969

ASA SUBCOMMITTEE X3.2 - CHARACTER SETS AND DATA FORMAT

MINUTES

Meeting #21 of July 25 - 27, 1962
Cockatoo Hotel, Hawthorne, California

SUMMARY

Efforts were devoted to consideration of criticism of proposed ASCll and completing drafts of replies to position papers. A new secretary was appointed. Delegates to ISO TC/97 meetings of October 8 - 18, 1962 were chosen.

APPENDICES

I Agenda

II Liaison Report #1, TR-27.6.3/X3.2 (July 18, 1962).

III Joint Meeting of X4A4 and X3.2 Working Group on X4A4 Resolution (July 9, 1962).

IV Membership List - July 27, 1962

V Letter from ECMA TC 1 in Support of WG-B Proposal

NMAH
310/3

MINUTES OF X3.2 MEETING OF JULY 25 - 27, 1962

0.0 Proposed Agenda presented by Chairman as shown in Appendix 1 was accepted.

1.0 ATTENDANCE

L. Griffin	Dept. of Navy	P(Chairman)
J. Chesterman	Bell Labs.	P
J. Auwaerter	Teletype Corp.	P
J. Booth	Teletype Corp.	A
J. Trawick	ITT (I.E.C.)	A
D. Hudston	ITT (L.C.S.)	O(Observer)
R. Blue	IBM	P
M. Franklin	IBM	proposed alt.
C. MacKenzie	IBM	consultant
E. Clamons	Univac	proposed alt.
P. Quantz	Burroughs	P
H. Tholstrup	Friden	P
R. Muise	Minn-Honeywell	P
A. Hassan	NCR	P
S. Porter	NCR	A
C. Whitaker	NCR	O
R. Hunter	NCR	O

Membership list is given in Appendix IV.

Former Members

C. Macon and L. Bloom attended on July 26th and served as consultants.

2.0 DOCUMENTS DISTRIBUTED AT THIS MEETING

Minutes of previous meeting were distributed by J. Chesterman, acting secretary, and approved as amended.

3.1 MEMBERSHIP

M. Franklin was proposed as Alternate member by IBM replacing J. **Bartelt**

James Trawick was accepted, by vote, as Alternate Member - I.T.T.

D. Hudston of I.T.T. Communication Systems attended as Observer.

A. Hassan was accepted as Member from NCR.

S. Porter was accepted as Alternate member from NCR.

Charles MacKenzie of IBM was offered in capacity of consultant.

R. Utman has resigned from X3.2, having accepted the staff position of Director of Standards, BEMA as of July 2nd.

E. H. Clamons was submitted as alternate for Ted Bonn of Univac but, not having attended a previous meeting, was not voted in as alternate at this meeting.

H. Layton was accepted as member from Monroe.

A motion was passed extending a 30-day grace period to RCA; after which they would be dropped if attendance rules were not complied with.

3.2 A. H. Hassan was elected Secretary.

3.3 The Chairman appointed the following delegation to attend ISO TC/97 and WG B&D meetings in Paris, France to be held during the period October 8 - 18, 1962.

J. Auwaerter	-	Teletype, X3.2 International Representative
R. Blue	-	IBM
A. Hassan	-	NCR
P. Quantz	-	Burroughs
L. Griffin	-	Federal Gov't., X3.2 Chairman

3.4 Changes in X3.2 member participation in AIEE October 1962, Panel Discussion on Proposed Code:

X3.2 members to be present are:

T. Bonn, J. Booth and either M. Franklin or C. E. MacKenzie.

4.0 REPORTS OF TASK GROUPS AND WORKING GROUPS

R. Muise submitted Liaison Report #1 of TR 27.6.3/X3.2 (Magnetic Tape), of which the first two pages are attached to these minutes as Appendix 1

C. Whitaker, chairman of Joint Task Group on Punch Cards, who was present as an observer, was asked to report on this committee's activities. He stated that the Joint Steering Committee has not specifically directed the group to direct its efforts toward examining implementation of proposed ASCII in punch cards. However, a motion was passed to this effect in the group and attention will be directed to this topic. Next meeting to be held August 14 - 15.

Two methods of extending the existing Hollerith Code to a larger character set are also to be examined, as well as the method proposed by Leon Bloom for implementing proposed ASCII in punch cards.

L. Griffin stated that three methods were to be examined:

1. Extension of current code used in 80 column cards.
2. Modification of this code for ease of conversion (to X3.2 code).
3. Development of new card code closely related to X3.2 proposed code.

J. Booth presented report in writing on meeting of X4A4 with X3.2 working group on X4A4 resolution. This report is included as Appendix 111.

J. Booth reported on his meeting with the Computer Standards Subcommittee of the AIEE Computing Devices Committee on July 6th, and distributed a record in writing of that meeting. It was moved by R. Muise, and seconded by P. Quantz that:

"J. Booth be appointed temporary liaison representative with Computing Standards subcommittee of AIEE Computing Devices Committee to resolve differences re proposed ASCII". Motion passed.

A letter was received from ECMA TC/1 indicating support of WG B proposal, together with certain comments. (See Appendix V.)

5.0 NEW BUSINESS

Machine Tool Control problem was discussed as a possible new business topic but was deferred pending further investigation.

6.0 DRAFTING OF REPLIES TO POSITION PAPERS

The Chairman made working assignments for completion of drafting of replies to position papers and minority reports. The subcommittee recessed to perform this work.

7.0 At the close of official meeting on July 26th, the following motion was made by P. Quantz and seconded by J. Auwaerter:

> "The following minority reports and positional papers have been reviewed. None of the points, either individually or collectively, were deemed necessary or sufficient to warrant revision or withdrawal of the PASCII of May 25th, 1962.
>
> 1) IBM Position Paper dated June 6, 1962.
> 2) Friden Position Paper dated July 13, 1962.
> 3) Monroe Position Paper dated June 13, 1962.
> 4) Subcommittee Minority Position Paper dated June 7, 1962.
> 5) Subcommittee member's negative vote (R.E.Blue) dated June 5, 1962.
> 6) Subcommittee member's abstaining vote (A.Ungar) dated June 11, 1962."

The motion was passed 6 AFFIRMATIVE, 2 NEGATIVE.

8.0 Next meeting to be held at BEMA, headquarters, NYC., on August 22 and 23.

A. H. Hassan

A. H. Hassan
Secretary, X3.2

Appendix I

ASA X3.2 - Character Sets and Data Formats

AGENDA - Meeting of July 25-27, 1962, Cockatoo Inn and Hotel,
4334 W. Imperial Highway, Hawthorne, California
Telephone - Area Code 213 OS 9-2291

1. Attendance
2. Minutes of previous meeting
3. Administrative Business
   - 3.1 Resignations and new members
   - 3.2 Appointment of Secretary
   - 3.3 Appointment of international delegation to ISO TC-97 and WG-B&D meeting in Paris, France, October 8-18, 1962
   - 3.4 Changes in X3.2 member participation in AIEE October 1962 Panel Discussion on Proposed Code
4. Reports of Task Groups and Working Groups
   X4-A4-
5. New business and work assignments
6. Final drafting of rebuttals to position papers

Appendix IV

ASA X3.2 Membership List
July 27, 1962

Member	Alternate
Mr. John F. Auwaerter Director of Product Development Teletype Corporation 5555 Touhy Avenue Skokie, Illinois Tel: 312 OR 6-1000 (Ext. 6302)	Mr. John B. Booth Teletype Corporation 233 Broadway Room 624 New York, New York Tel: 212 WO 2-1876
Mr. Robert E. Blue IBM Corporation 112 East Post Road White Plains, New York Tel: 914 WH 9-1900 (Ext 5962)	Mr. M. J. Franklin (Proposed) IBM Corporation Data Systems Division South Road Laboratory Poughkeepsie, New York Tel: 914 GL 4-1000 (Ext 5886M)
Theodore Mr. T. H. Bonn Univac Division-Sperry Rand Corp. P. O. Box 500 Blue Bell, Pennsylvania Tel: 215 MI 6-9000 (Ext.2106)	Mr. E. H. Clamons (Proposed) Univac Division-Sperry Rand Corp. P. O. Box 500 Blue Bell, Pennsylvania Tel: 215 MI 6-9000 (Ext.404)
Mr. J. F. Chesterman Bell Telephone Labs (2F 517) Holmdel, New Jersey Tel: 201 949-3968	None
Mr. L. L. Griffin Navy Management Office Navy Department Washington 25, D. C. Tel: 202 OX 6- 7277	None
Mr. R. M. Gryb American Tel. & Tel. Co. 195 Broadway New York, New York Tel: 212 393-3671	None
Mr. A. H. Hassan National Cash Register Co. Electronics Division 1401 E. El Segundo Blvd. Hawthorne, California Tel: 213 PL 7-1811	Mr. S. N. Porter National Cash Register Co. Electronics Division 1401 E. El Segundo Blvd. Hawthorne, California Tel: 213 PL 7-1811

Member	Alternate
Mr. Harry Layton Monroe Calculating Machine Co. 555 Mitchell Street Orange, New Jersey Tel: 201 OR 3-6600	Mr. M. Mendelsohn Monroe Calculating Machine Co. 555 Mitchell Street Orange, New Jersey Tel: 201 OR 3-6600
Mr. Richard M. Muise Minneapolis-Honeywell EDP 151 Needham Street Newton Highlands 61, Mass. Tel: 617 DE 2-6960 (Ext 236)	Mr. T. R. Bousquet Minneapolis-Honeywell EDP 151 Needham Street Newton Highlands 61, Mass. Tel: 617 DE 2-6960 (Ext 374)
Mr. Paul Quantz Burroughs Corporation 460 Sierra Madre Villa Pasadena, California Tel: 213 SY 3-6121	Mr. George Shimabukuro Burroughs Corporation 460 Sierra Madre Villa Pasadena, California Tel: 213 SY 3-6121
Mr. H. Tholstrup Commercial Controls Corporation Friden, Inc. One Leighton Avenue Rochester 2, New York Tel: 716 BU 8-1600	None
Mr. Alan Ungar International Tel. & Tel. Co. Box 285 Paramus, New Jersey Tel: 201 CO 2-6800 (Ext 881)	Mr. James Trawick International Tel. & Tel. Co. Box 285 Paramus, New Jersey Tel; 201 CO 2-6800 (Ext 503)
Mr. H. Kleinberg Manager Computing Devices Eng. Radio Corporation of America Electronic Data Processing Division Camden 2, New Jersey Tel: 609 WO 3-8000	Mr. H. Spielman Computing Devices Eng. Radio Corporation of America Electronic Data Processing Division Bldg. 82-1 Pennsauken, New Jersey Tel: 609 WO 3-8000 (Ext PC 2044)

Consultants

Mr. H. J. Smith
IBM Corporation
Poughkeepsie, New York

Mr. C. E. MacKenzie (Proposed)
IBM Corporation
Data Systems Division
South Road Laboratory
Poughkeepsie, New York
Tel: 914 GL 4-1000

ECMA
EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION

Appendix V

GENEVA RUE D'ITALIE 11
CABLE ADDRESS EUCOMANUFAS GENEVE
PHONE 022 · 28 22 87
P.C.A. I 16504

M. J. B i r l é
Directeur Général de l'AFNOR
23 rue Notre Dame des Victoires
PARIS II
France

OUR REF. He/fr
YOUR REF

DATE Geneva, 27th June, 1962

Dear Mr. Birlé,

The ECMA TC Committee on Codes met on 5th and 6th June, 1962, and the results of the WG-B meeting have been carefully considered. We are, hereafter, submitting you the following comments:

1. The ECMA TC-1 committee generally supports proposal B of the ISO meeting in both its seven and six bit forms. However, the committee would like to submit the following comments for consideration.

2. Comments on the controls

The table showing the proposal should be modified as follows:

2.1 7 bit set

FE_2 - (NL) or (LF)

FE_5 - (BS) or (CR)

where the choice of either NL or LF determines the corresponding meaning of FE_5.

2.2 6 bit set

F_2 - (NL) or (LF)

F_5 - Spare or (CR)

where the choice of LF for F_2 requires the selection of CR for F_5; otherwise the meaning of F_5 is unspecified.

3. Comments on the graphic symbols

../..

3.1 7 bit set

a) The ECMA committee suggests the transposition of * with : and + with ;

b) The table of the 7 bit set should show the sign " O " in the 3 positions following the alphabet, so that reference is made to Note 1 of the ISO report.

c) The portion of the code table marked as "unassigned should be reserved for graphic information, i.e. it should not be used for controls.

d) The $ sign should be replaced by "currency sign".

3.2 6 bit set

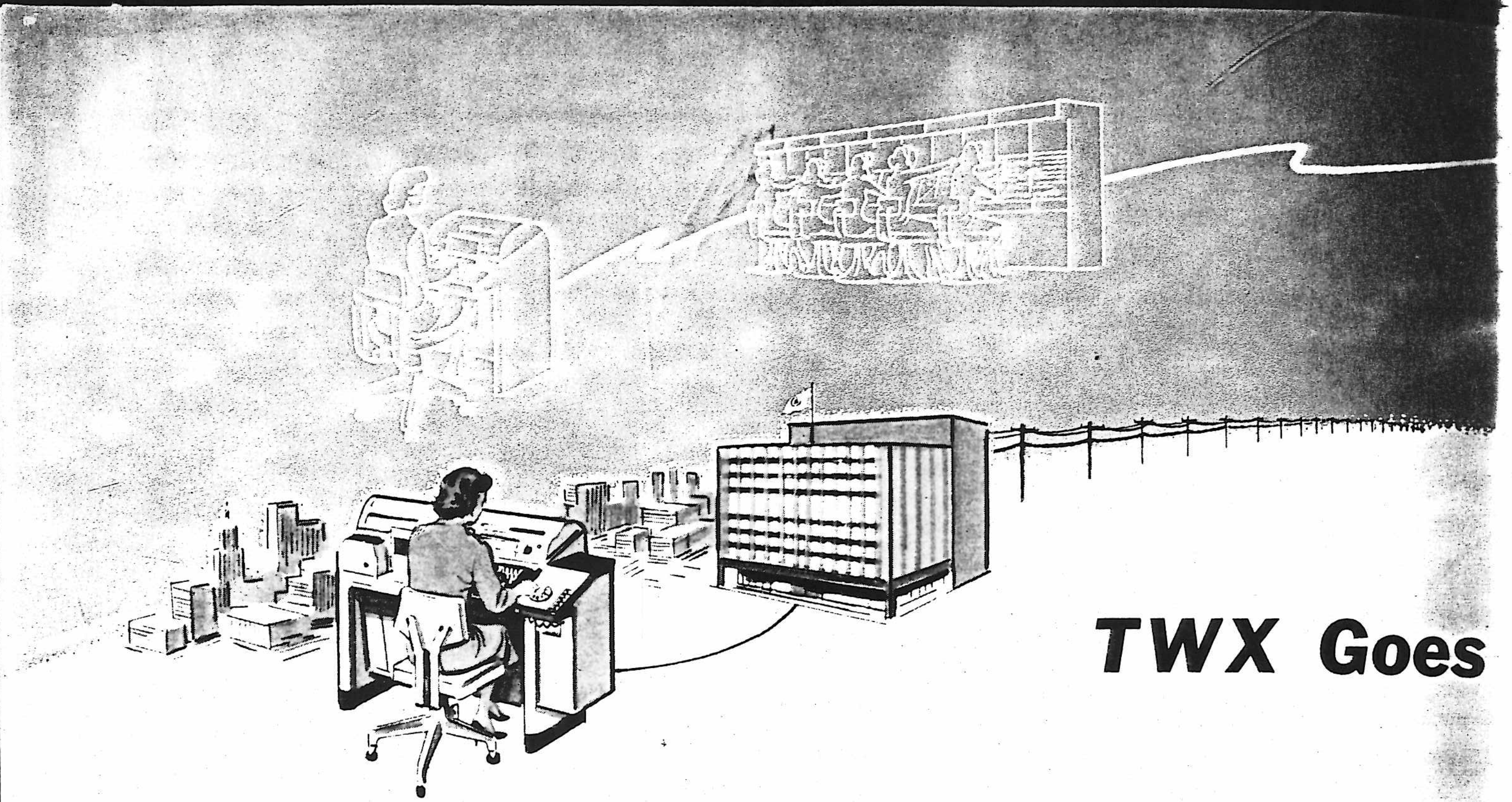
It is suggested that the bottom 6 positions as shown in the second column of the table be amended to read:

10 or :
11 or ;
Cur. Sign or <
% or =
& or >
' (apostr.) or ?

3.3 If these suggestions were adopted, it would become unnecessary to retain Notes 2 and 3 of the ISO report, and the references to them in the code tables would be deleted.

Yours faithfully,

D. Hekimi
Secretary General



TWX Goes

The first nationwide cutover in the history of telephony—one that will involve every operating company in the Bell System and many independent telephone companies—will take place on August 31, 1962. When it is accomplished, some 60,000 teletypewriter exchange (TWX) stations in the United States will begin to dial their calls over the Bell System's direct distance dialing (DDD) network. Almost 900 central offices will be switching centers for the TWX stations.

Since TWX service was started in 1931, its calls have been switched manually; at present 100 switchboard locations are needed to handle the traffic. Most of these have trunks to only 10 other locations in the network; none has trunks to all others. These limited trunking paths, and the fact that the average TWX call covers about 800 miles, results in a large number of multi-switch connections that must be handled by operators. Manual handling of calls is a costly procedure and it requires about two and a half minutes to set up a call. These and other considerations made it desirable to mechanize TWX service as soon as possible.

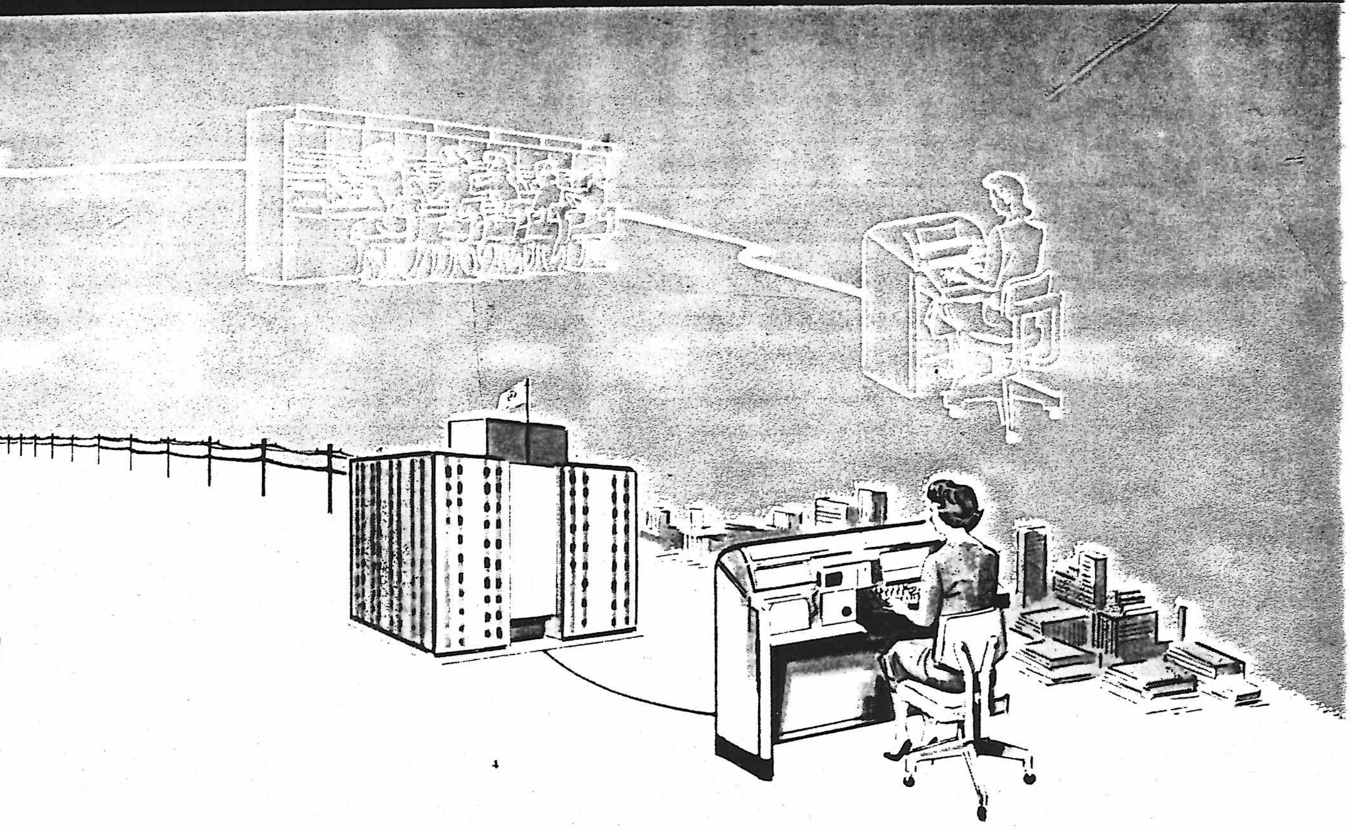
Tying TWX stations into the DDD network permits the telephone industry to convert them to dial operation in the minimum of time and TWX service will benefit in a number of ways. First, the DDD network will reduce the average time to set up a call to about one-half minute. Second, it will permit customers to place calls in the same manner as telephone calls. Thus, a minimum of customer training will be required. Third, it will reduce the interval from receipt of an order to service because ordinary telephone loops can be used rather than special telegraph loops.

Each TWX station will be assigned a ten digit telephone number. TWX stations will complete calls over the DDD network in much the same manner as telephone stations, but two-way voice communications with telephone stations or to other TWX stations will not be possible. Assistance, collect, conference and similar calls will be handled through switchboards recently designed at Bell Laboratories which will be located at 16 operating centers throughout the country (see the map on page 236), and reached from any TWX station by dialing a special seven digit number. There will also be one information center located in St. Louis, Missouri. All communication with TWX operators will be by teletypewriter machine.

TWX transmitting and receiving stations will

July - Aug 1962
vol 40 #7

es Dial



E. J. Tyberghein

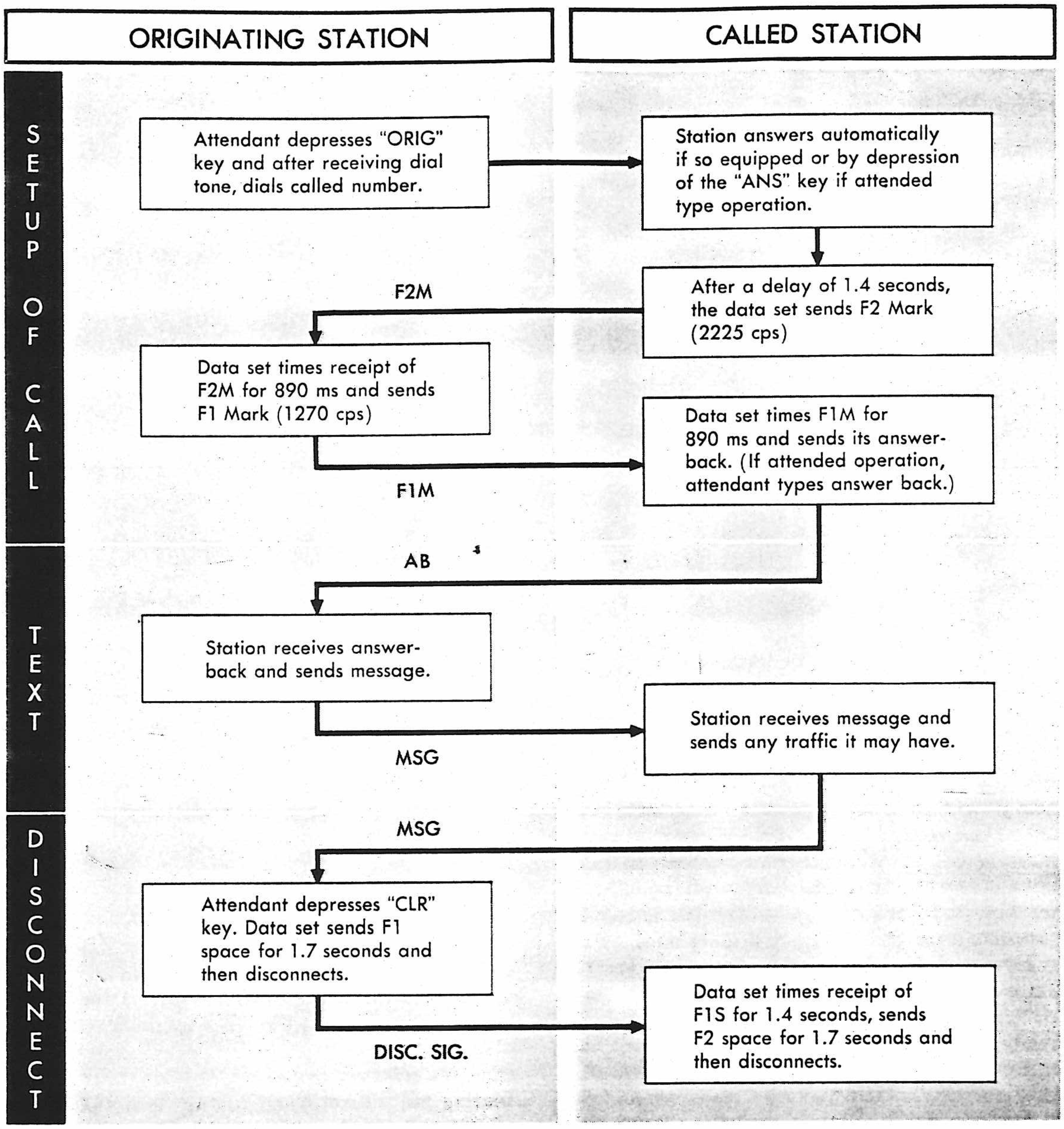
retain the same teletypewriter machines that are in use today: Types 14, 15, 19 and 28. Each machine will provide either manual or automatic answer service. Automatic answer 15 and 19 type machines will answer by sending the letter "V" to indicate to the calling station that they are ready to receive. Automatic answer 28 type machines will send a multicharacter answer which will identify the called station and indicate it is ready to receive.

New Station Equipment

A newly developed data set and an attendant set are intermediate equipment between TWX stations and their serving central office loops. Together, they will (1) convert the dc teletypewriter signals into mark and space carrier frequencies in the voice frequency band; (2) provide all necessary machine control functions; and (3) provide assurance that the transmission circuits are functioning. (If the signal in either direction is lost for approximately one second, both stations will be disconnected.) In addition, the attendant set will provide a means of dialing into the serving central office, and of listening to call progress tones such as dial tone, busy tone, reorder, etc.

A very natural sequence is followed in setting up a call as shown on the next page. The TWX attendant originates a call simply by depressing the ORIG key on the attendant set. Dial tone is returned, and the attendant dials the station she wishes. The called station answers and, after a slight delay to permit off-hook supervision to propagate back to the originating central office, sends F2 mark tone. The F2 tone (2225 cps) disables any echo suppressors in the path and enables the data set at the originating station. The originating station returns F1 mark tone (1270 cps) which enables the data set at the terminating station. When both stations are enabled, the called station sends its multicharacter or "V" answer-back. At this point, both stations are ready to send or receive messages in turn. The originating station always sends its data signals in the F1 band and receives in the F2 band. The called station sends in F2 and receives in F1. An attendant at either station can end the call simply by pressing a CLR (clear) key on the attendant set. For a disconnect signal, the originating station sends F1 space tone (1070 cps) and the called station sends F2 space (2025 cps).

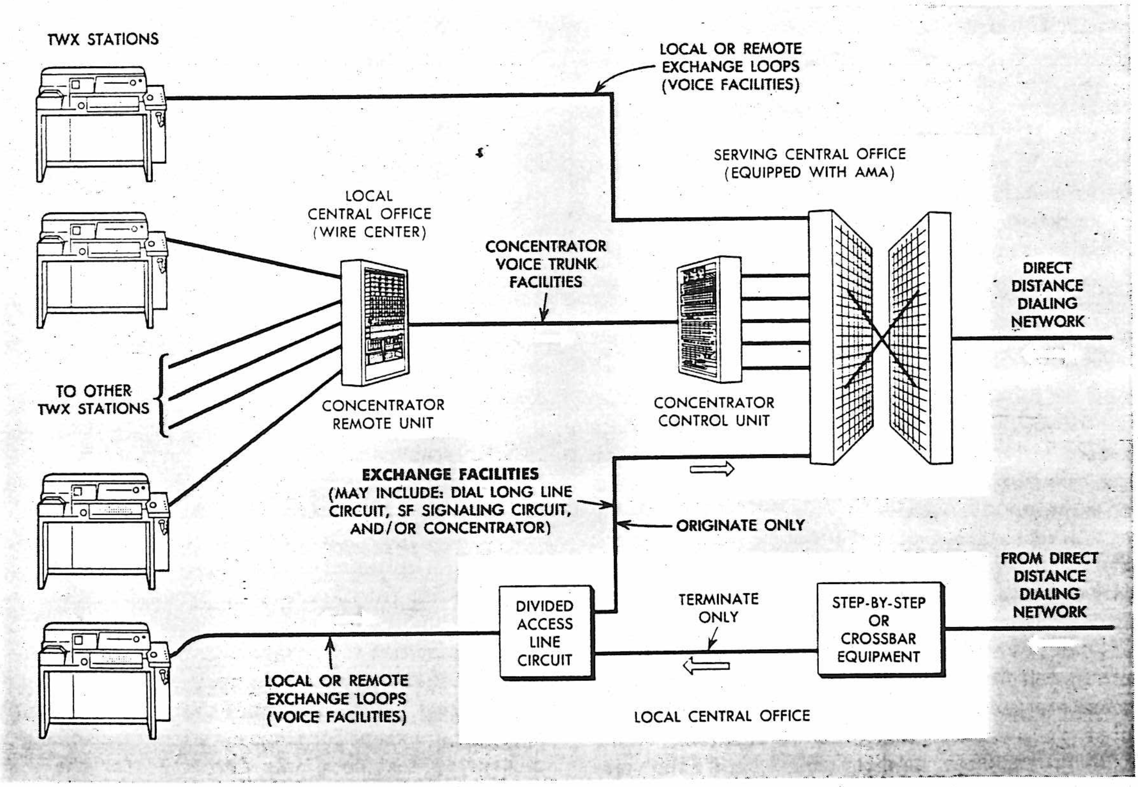
TWX calls will continue to be billed on an


ORIGINATING STATION
CALLED STATION
SETUP OF CALL
TEXT
DISCONNECT
Attendant depresses "ORIG" key and after receiving dial tone, dials called number.
Station answers automatically if so equipped or by depression of the "ANS" key if attended type operation.
After a delay of 1.4 seconds, the data set sends F2 Mark (2225 cps)
F2M
Data set times receipt of F2M for 890 ms and sends F1 Mark (1270 cps)
Data set times F1M for 890 ms and sends its answer-back. (If attended operation, attendant types answer back.)
F1M
AB
Station receives answer-back and sends message.
Station receives message and sends any traffic it may have.
MSG
MSG
Attendant depresses "CLR" key. Data set sends F1 space for 1.7 seconds and then disconnects.
Data set times receipt of F1S for 1.4 seconds, sends F2 space for 1.7 seconds and then disconnects.
DISC. SIG.

A call between teletypewriter stations will be set up in the steps shown in this drawing. When a teletypewriter console is unattended at a dial TWX *station, an answerback mechanism indicates automatically to the calling party that the station has answered and that it is ready to receive messages.*

individual message basis and therefore automatic message accounting (AMA) records of all calls will be kept. Centralized AMA equipment with operator identification of the calling customer cannot be used because voice communication is not possible. No. 5 crossbar offices with local AMA are preferred for this service, but they do not exist in all areas serving TWX stations. Consequently, some step-by-step offices with automatic number identification (ANI) and CAMA, and some No. 1 crossbar offices with LAMA or ANI CAMA will be used.

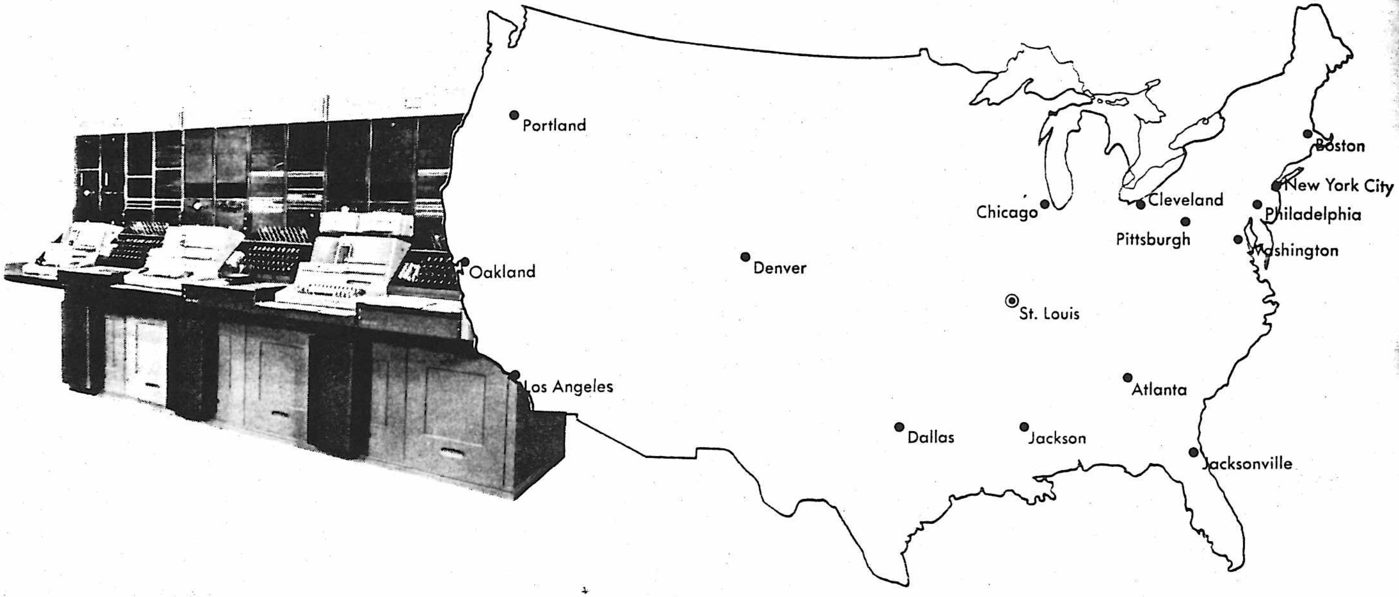
The charge per message depends on the distance and duration of the call. Mileage is determined by the distance between the rate center areas in which the stations are located. In order to keep message sorting at the various accounting centers to a minimum, it is desirable to assign a different central office code for each rate center involved. If separate codes are not assigned, it will be necessary to sort messages from TWX stations by the thousands or possibly even the hundreds digit of the called station's number. However, there are not yet enough AMA and ANI CAMA central offices located in the right spots around the country. Hence, we cannot provide all the rate center codes we need.


TWX STATIONS
LOCAL OR REMOTE EXCHANGE LOOPS (VOICE FACILITIES)
SERVING CENTRAL OFFICE (EQUIPPED WITH AMA)
LOCAL CENTRAL OFFICE (WIRE CENTER)
CONCENTRATOR VOICE TRUNK FACILITIES
DIRECT DISTANCE DIALING NETWORK
TO OTHER TWX STATIONS
CONCENTRATOR REMOTE UNIT
CONCENTRATOR CONTROL UNIT
EXCHANGE FACILITIES (MAY INCLUDE: DIAL LONG LINE CIRCUIT, SF SIGNALING CIRCUIT, AND/OR CONCENTRATOR)
ORIGINATE ONLY
FROM DIRECT DISTANCE DIALING NETWORK
DIVIDED ACCESS LINE CIRCUIT
TERMINATE ONLY
STEP-BY-STEP OR CROSSBAR EQUIPMENT
LOCAL OR REMOTE EXCHANGE LOOPS (VOICE FACILITIES)
LOCAL CENTRAL OFFICE

Shown here are typical line and trunking arrangements that will be used to serve the new dial TWX *stations. The divided access line circuit solves a problem of rate center codes by allowing* TWX *stations to place a call through one central office and to receive through a second central office.*

To solve this problem, Laboratories engineers developed a divided access line circuit (DALC) which makes it possible for a TWX station to originate messages via one central office (having AMA or ANI CAMA) and receive incoming messages via a different central office which has the proper rate center code. Several typical line and trunking arrangements for serving dial TWX stations are shown in the drawing above. Only voice bandwidth loops are used; loop plant investments are kept to a minimum by using the 1A line concentrator with new arrangements that permit it to operate with carrier transmission trunks.

DDD central offices will be able to handle TWX traffic with the relatively few changes that have been outlined. Some changes also will be made in the interoffice trunk facilities. First, some trunk groups will be enlarged to accommodate the additional load. Secondly, all 2000 cps SF signaling units (a relatively small portion of the single frequency units in plant) will be replaced by 2600 cps SF signaling units. If this were not done, F2 frequencies (2125 ± 100 cps) would cause false operation of the 2000 cps SF receivers. Thirdly, because a receiving TWX station must be able to send a "break" or stop signal while the other station is sending, an echo suppressor disabler will be installed on every echo suppressor that



This assistance switchboard was developed at the Laboratories specially for dial TWX *service. These boards will be located in the cities shown on the map and will share a special seven-digit telephone number. An attendant at any* TWX *station who wishes assistance with collect calls, conference calls, etc., can dial this number and be connected with the switchboard assigned to serve her area.*

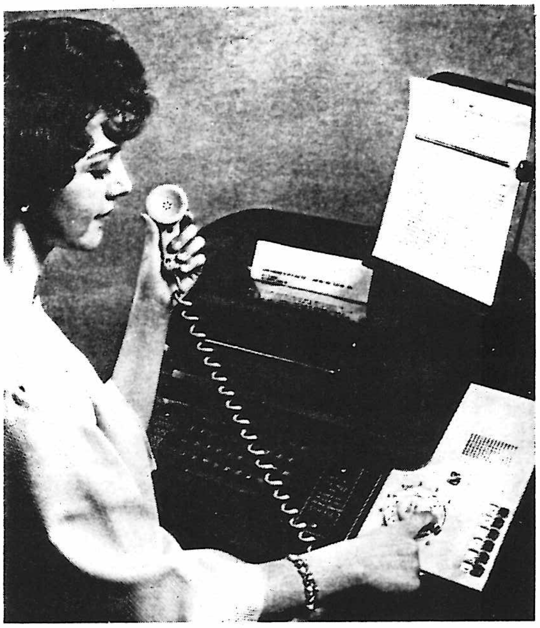
may be encountered by a TWX call.

The disabler was developed especially for data transmission over the DDD network. It works with the echo suppressor in the following manner: The echo suppressor monitors the signal energy present in both sides of a four-wire circuit (both directions of transmission) and introduces a high loss in the side that has the lower signal energy. It is the purpose of the disabler to remove this high loss when the circuit is used for data transmission. To accomplish this purpose, the disabler monitors each side of the four-wire facility for energy in two bands—the conditioning band (2000 to 2250 cps) and the guard band (the voice band outside of the conditioning band). Whenever the energy in the conditioning band is sufficiently in excess of the energy in the guard band for 350 milliseconds (±50 milliseconds), the echo suppressor is disabled; that is, the high loss is removed. If sufficient energy outside of the conditioning band is present on either side of the line, it will prevent the echo suppressor from being disabled. Thus, voice communication cannot disable the echo suppressor. After it is disabled by F2 frequency from the terminating station, the suppressor is kept disabled by energy in either band. A loss of signal for 100 milliseconds causes the suppressor to return to normal.

TWX customers will report trouble by telephone to their local operating telephone companies. A test desk man at the company will analyze the trouble reported and determine what course of action is required. Under his direction, the customer may dial up an automatic test line (ATL) and use it to determine the nature of the trouble. If an operating company craftsman is sent to the TWX station he may use the ATL to determine the trouble, or he may use his portable test equipment, or he may place a call to a manned test center. All test equipment, except for some standard transmission measuring test sets, was developed for the dial TWX system.

Automatic Test Line

The automatic test line permits one-man testing of the over-all operation of a TWX station. After it is reached through a dialed-up connection, it automatically sends standard teletypewriter test signals (the quick brown fox, etc. . . .) under various conditions of carrier signal level and distortion. The condition of the teletypewriter machine and that of the data set and loop is determined from the printed copy at the teletypewriter. After the station is thus checked for its ability to receive,



An attendant uses the new subscriber set on a teletypewriter console equipped for dial TWX *service.*

it gets a typed request from the ATL to transmit. Any distortion in transmission is automatically measured by the ATL and a "TRAN OK," indicating good transmission, or "OUT LIM," indicating a fault, is automatically typed back.

All the automatic features of the new system would be of little value to TWX customers if they did not assure an error performance at least as good as, and preferably better than, that of the present manual system. Field tests conducted jointly by the A.T.&T. Co., the operating companies, and the Laboratories indicate that there is a 99 per cent probability of sending a ten line message without errors due to transmission. Usually an error affects only one character; occasionally one will affect several characters. The rate of errors will vary depending on the kind of facilities a call is routed over and the number of links involved. Some customers will have a slightly higher rate, some lower.

Many customers will find dial-operated TWX service attractive for their data traffic. Customers with a very heavy traffic load will, of course, require much more sophisticated station equipment than has been offered in TWX service. In anticipation of this, new station equipment is being designed, so that, like dial-operated TWX, services can be offered with all the facilities customers may need.

Eastern Third of Blast-Resistant Cable System Nears Completion

The Bell System will complete the eastern third of its blast-resistant transcontinental cable system late this summer as part of its continuing program to insure the survivability of communications.

All the cable, amplifier stations and communications centers are being constructed underground, engineered to withstand any nuclear blast short of a direct hit. The system will be completed to the west coast by 1964.

The buried cross-continent system will transmit telephone calls, data and other communications and will interconnect with existing microwave and coaxial express routes. These criss-cross the nation and include bypass routes around potential target areas. The underground system, which also avoids large cities and major target areas, will represent a Bell System investment of about $200 million when completed.

The subterranean complex will include almost 4,000 miles of coaxial cables, more than 900 intermediate amplifier stations and nine communications centers linking the new route to conventional facilities. The cable is being buried deep underground, and all amplifiers and terminal equipment are housed in reinforced concrete buildings protected by thick earth cover. Manned stations are protected from radioactive fallout.

The communications centers, buried one to two stories deep, have reinforced concrete floors, ceilings and outer walls 18- to 24-inches thick. In emergencies, each center can generate its own power and has reserve water and fuel supplies. Food is stockpiled, and there are emergency living facilities for operators, technicians and maintenance men. Each center's ventilation system is controlled by a sensing device which would react immediately to nuclear blast. Blast valves in the underground buildings would close automatically, filtering equipment would cut in to prevent fallout from entering, and other equipment would constantly check radioactivity.

The only part of each building above ground is a small entrance structure. Personnel enter through a guarded two-door "entry lock" and pass through a fallout decontamination room before reaching the operations areas.

When fully equipped, the new transcontinental system will add about 9,000 telephone circuits to the 15,000 now spanning the country.

AUG 15 1962

UNIVAC

Intercommunication

TO: W. R. Lonergan

CC: T. H. Bonn
F. W. Bauer
R. W. Bemer

FROM: E. H. Clamons

CITY & DATE: Blue Bell - 8/10/62

DEPARTMENT: Product Planning

SUBJECT: ASA X3.2 PROPOSED STANDARD CODE

On July 25 and 26, I attended the meeting of the X3.2 Subcommittee on Codes.

Review

Early in the spring of 1962, the committee submitted a proposed standard code which was to be voted upon by the X3 Engineering Committee. Since then several events took place:

> The original standard was proposed on February 19, 1962; a meeting was held with ECMA which resulted in a few changes in the sequence of symbols. The new code published May 25, 1962, represents the result of the combined efforts of the X3.2 and working Group B of the ISO.
>
> The TC-95, TC-97 and TC-53 groups, among others, will hold a marathon standards session in Paris, October 8-18, 1962. At this meeting, the Europeans are expected to request assignment of all presently unassigned codes.
>
> The X3.2 Committee is now working with other committees (paper tape, magnetic tape) to determine implementations of the code in the various media.
>
> IBM has taken a negative position and would prefer to have their present standard Hollerith based code be the standard. They want the X3.2 Committee to branch into economic considerations. While they recognize that the committee has tacitly considered the economics of adopting the new code, they would like to have these considerations brought out into the open.
>
> Datamation has requested and received permission to publish IBM's negative position on this code as well as the reply of the X3.2 majority.
>
> The ITT representative is objecting because of the Air Force communication requirements.

NMAH 310/3

> Monroe and Friden object because of the financial burden they would have to bear both in the design of future equipments and the obsolescence of existing machines.

I would like to withdraw my technical objections to the proposed BEMA standard code for information interchange. The objections were weak in the first place and have been weakened further by the revision. Based on the code of February 2, I had recommended on June 12, 1962, that UNIVAC vote be "NO" for technical reasons. However, on May 25, 1962, X3.2 issued a revision which was not available to me then.

More significant than our technical objections are the objections voiced by Mr. R. C. Blue of IBM, who loudly and vociferously proclaimed the dominance of their Hollerith code by the sheer force of the number of IBM machines in the field. UNIVAC has recognized this force internally in adopting our current standard computer codes. But, the BEMA code is better than the Hollerith card based code. Even though Hollerith card will probably be with us for ten years or more (my opinion), its significance will gradually diminish. It would be foolish for us, or anyone else, to standardize on a code which does not satisfy the requirements of data processing and communications in the immediately foreseeable future.

The committee consists of a group of knowledgeable individuals from many companies. They are familiar with the requirements of the industry and represent some of the best talent available. The BEMA code is backed by excellent technical papers; every decision is based on thorough investigation of the needs of the industry; compromises were reached where necessary.

Economics

The financial implications to UNIVAC are quite clear. Hollerith card codes will not change if the standard is introduced. No manufacturer will be willing to retrofit their existing equipment, therefore, the adoption of the code will be gradual. Specifically, none of our UNIVAC I and II, File Computers and Tab equipment including the 1004 will have the ability to use this code for communication interchange directly. We as well as the competition will have to provide translation external to the central computer. Our binary machines in the 1100 series are not as code sensitive as our decimal machines. Existing software, based on the XS-3 code may force hardware translation but software translation may suffice--particularly in the 490 and 1107. UNIVAC III will not be affected in the immediate future since the IBM compatible tape synchronizer has a standard 64-64 translation capability. Internally it can translate in excess of 1,000,000 characters/minute which amounts to 3% of processor time in the worst on-line communications application known to us. The USSC is not code-sensitive since its paper tape channel is equipped with a translator. The X-line has a translate command capable of translating from any code to any other code at a rate of 3,000,000 characters/minute. The 7-bit code will slow processing somewhat.

ASA X3.2 PROPOSED STANDARD CODE

I cannot assess the cost to us in more concrete terms without further study. However, because we do not expect this change to be sudden and because our present product lines are extremely flexible, our adoption of the code is not a financial threat.

Recommendations

Since no other computer manufacturer besides IBM has made their position known we are in a position to gain public acceptance by submitting an affirmative vote for this code as soon as possible. This affirmative vote could be publicized at the same time IBM's paper and the committee's report are published.

As a major manufacturer we command a seat in the X3 Engineering Committee. UNIVAC should take steps to nominate someone to replace Mr. Chu without delay.

UNIVAC should take an official position opposing the investigation of economic aspects of the X3.2 committee in order to maintain the technical character of the work output of the group.

Because of ECMA's activities and UNIVAC's share of the European market, we should take an active part in the joint meetings between the American and European standards groups. We should obtain as soon as possible memberships on the European committees so that we could be represented on both sides of the Atlantic.

Because of the quality of the papers of the contributors to this committee, it is recommended that in addition to the continued active participation by UNIVAC the information obtained in this and other committees be more widely disseminated throughout UNIVAC. The progress and achievements of the committees should be formally published at intervals of three months.

NOTE: Mr. T. H. Bonn who is the official X3.2 representative for UNIVAC agrees with my review and recommendations.

Eric H. Clamons

Eric H. Clamons

EHC:fbk